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Light and Lighting

December 1961

The scene on the front at Scarborough during the recent A.P.L.E. Conference: this issue includes a report on the Conference and its associated exhibition together with a review of European street lighting policy and practice.

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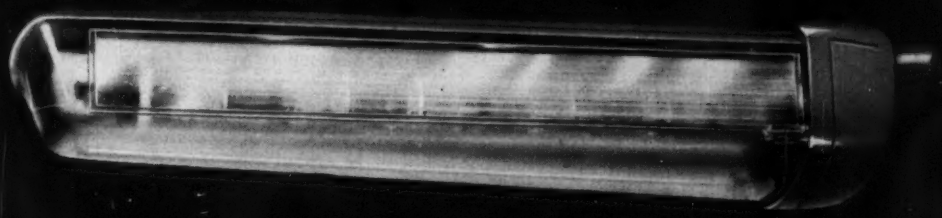
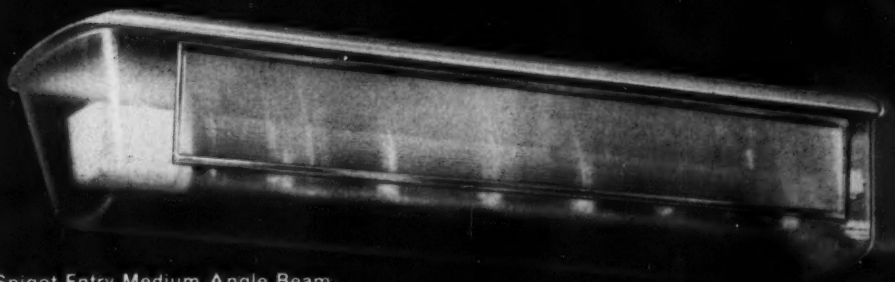
Service by Cable Car *(Photo Swiss Tourist Office)*

Amberline lanterns . . .

SL 3801 Side Entry Medium Angle Beam



SL 3802 Side Entry Cut-Off



SL 3800 Spigot Entry Medium Angle Beam

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Amberline lanterns have been designed specially for the Mazda 200-watt linear Sodium lamp, the first practical lamp in the world to achieve an efficiency of 100 lumens per watt.

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Another exciting member of Lightplan, Opalux fittings have the following qualities:

The Chassis—a one-piece chassis of first-quality sheet steel, surface-treated by degreasing and bonderizing, providing perfect protection against corrosion; finished in white gloss enamel applied by electrostatic process and high-temperature stoving in infra-red drying units.

The profile of the chassis allows the ballasts to be housed separately above the tubes, reducing the internal temperature of the fitting to permit the tubes to operate at near maximum lumen-output. This means that lumen output is approximately 15% higher than in conventionally designed fittings.

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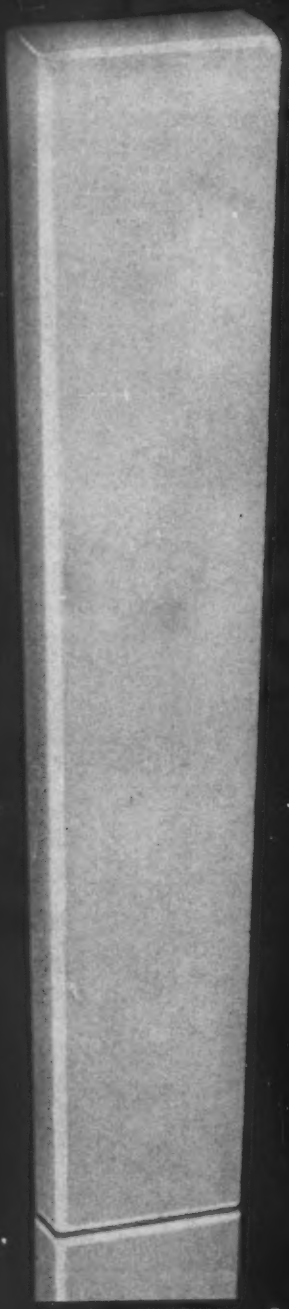
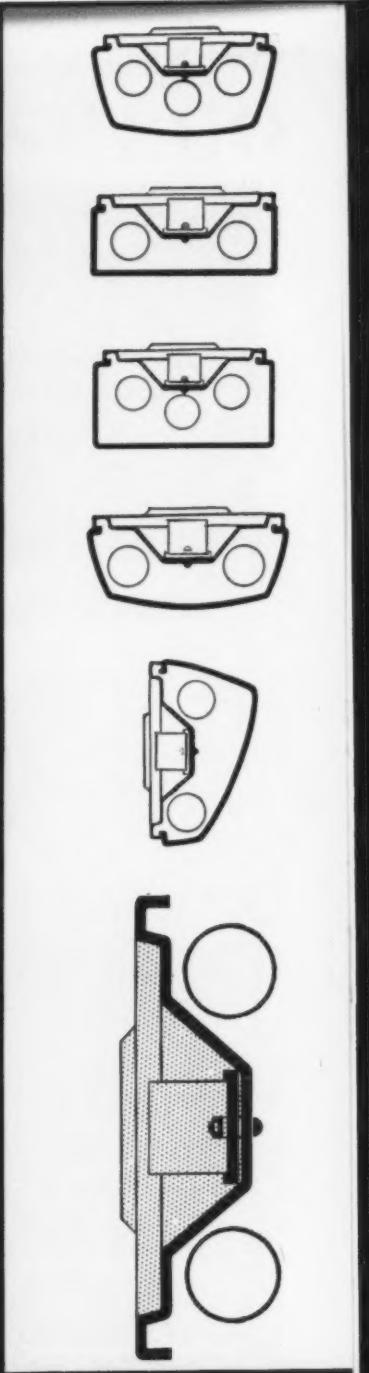
Electrical equipment—conforms to British Standards (where applicable) and is provided with earthing points. Wired ready for connection with capacitors, canister starter, bi-pin lampholders and separate ballasts, switch start.

Lightplan ballasts—conform to British Standards (where applicable), are cased in steel and vacuum-impregnated. Internal connections are terminated at connection blocks.

The diffusers—exclusive hinging and lever locks enable the diffusers to enclose the chassis so completely that no metal-work is visible. Made in 4' and 5' sizes, five designs in each size, they are moulded in one piece on steel dies from opal acrylic material. Exceptionally shallow, the diffusers give the fittings a 'built-in' appearance. Re-lamping is supremely easy, the diffuser conveniently hinging on the chassis.

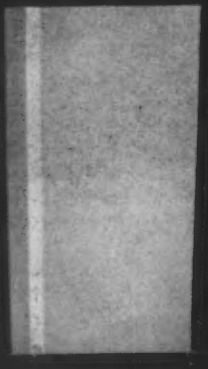




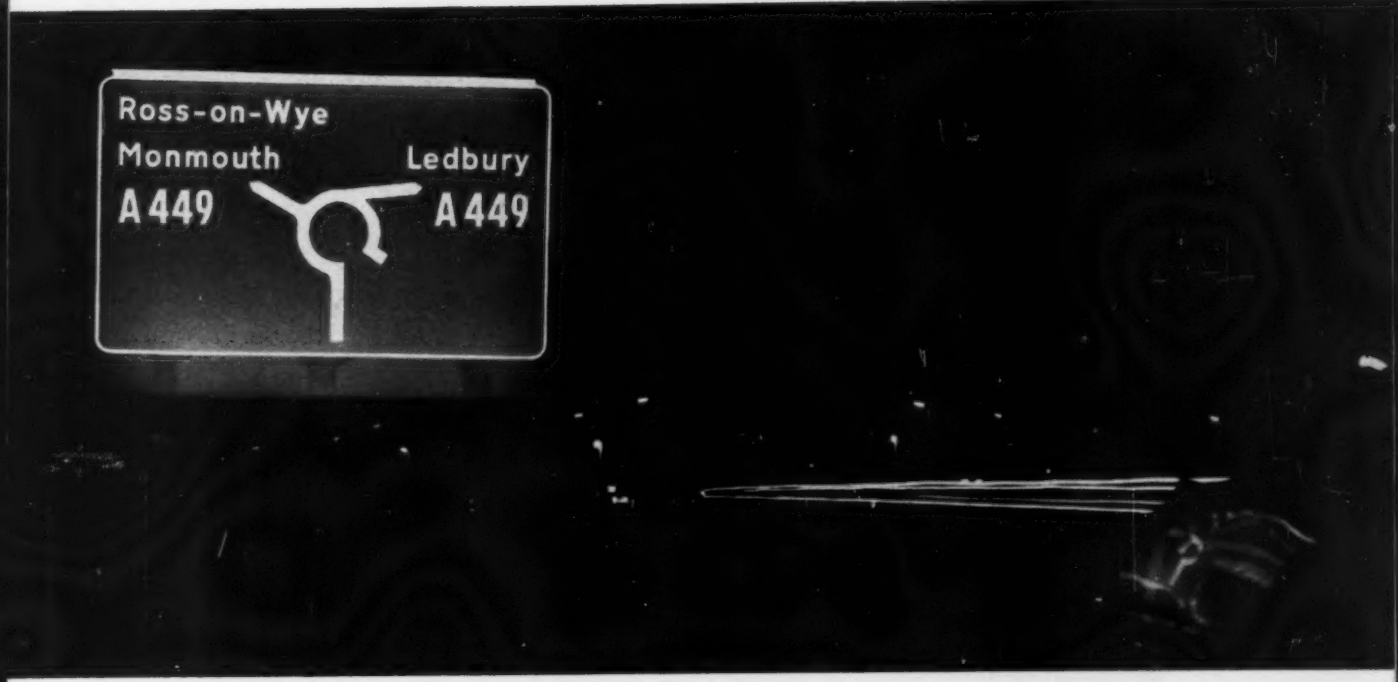
rotaflex lightplan opalux fluorescents

Lightplan, in devising these distinctive features, uses the resources of the Rotaflex Designs and Development Division, which offers the service of a team of technicians and designers for the preparation of specialised lighting schemes.

For further details of Opalux write for special leaflet L3 to Rotaflex House, Princes Street (Regent Street), London W.1. Tel: HYD 7611



Signs of the times...



Electrified by BICC CABLES

High-speed night traffic depends on reliable, well illuminated signs — signs that are vital to the safety and smooth running of Britain's motorways. Directional signs, keep-left bollards and street lighting points on the new Ross Spur motorway are supplied with electricity by BICC P.V.C. Insulated Single Wire Armoured Cables.

The installation was carried out — under extremely adverse weather conditions — by the Contracting Staff of the Midlands Electricity Board who affirm that the ease of handling the cables and the simplicity of jointing were important factors in the speedy completion of the job.

Fifty BICC Branch Offices provide a nation-wide service.

British Insulated Callender's Cables Limited, 21 Bloomsbury Street, London W.C.1

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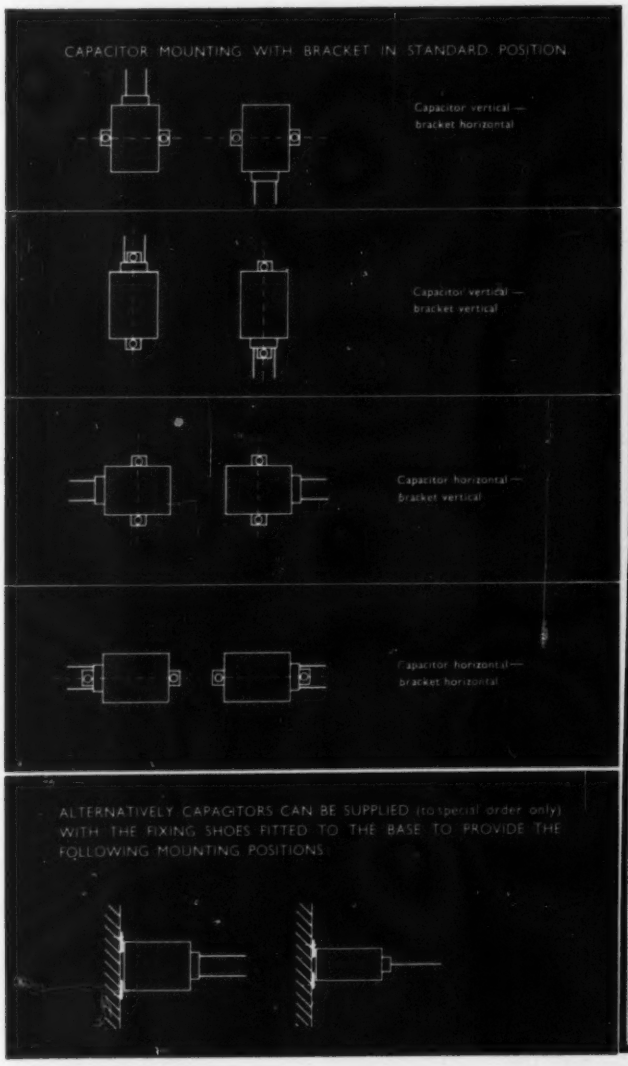
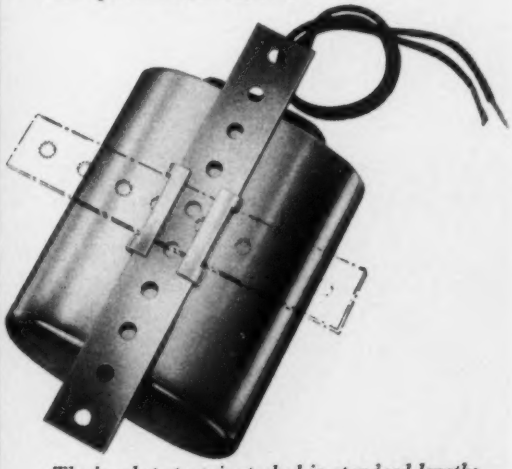
* new multi-position fixing bracket for the most compact of lighting capacitors.



TMC's reliable power factor correction capacitors (types OR, AR and HB) are now available with a completely adaptable bracket to hold the capacitor in *any* position, safely and securely. This feature and the compactness of TMC capacitors give you much greater mounting flexibility.

Constructed of specially processed mineral and synthetic impregnants, low-loss Kraft tissue and pure aluminium foil, these TMC capacitors are made in a wide range of capacitance values. The maximum cross-section for all values is 3″ x 2″ and the heights vary from 2¼″ for the 8 microfarad to 6¼″ for the 25 microfarad.

With a TMC capacitor and mounting bracket you can easily make a perfect job of any installation. Your next step? Ask for samples and quotations, of course.



The bracket strap is stocked in standard lengths of 4″, 5″, 6″ and 7″. Other lengths can be supplied to order.

TMC

TELEPHONE MANUFACTURING COMPANY LIMITED
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'SOLUMBRA' POST-TOP LANTERN
For side road lighting, using 100/200 watt tungsten or 80/125 watt MB/U or MBF/U.

'HELION' POST-TOP LANTERN
For town centre and main road lighting, using 2 or 3 x 250/400 watt MBF/U or 3 x 140 watt sodium lamps.

REVO ELECTRIC

Shown on these pages are some of the more recently developed lanterns of Revo Street Lighting research. Each has been designed to do a specific job with the utmost efficiency and still retain a high aesthetic standard.

BUT Revo engineers and designers can do much more than that. Complete lighting schemes are prepared which take into consideration type of road, volume of traffic, position and type of buildings and trees and local amenities. Proposals are made regarding spacing and location of columns, type of lantern and lamp and mounting height. Fully trained teams are then available to make the entire installation if required.

REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE

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'HORIZON' SIDE-ENTRY LANTERN
For main road lighting using 250/400 watt MBF/U Colour Corrected or MA/V tubular Mercury lamps.

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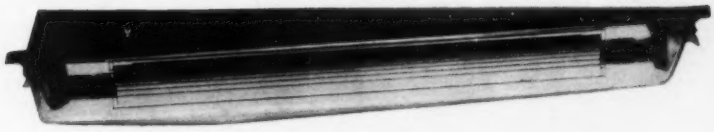
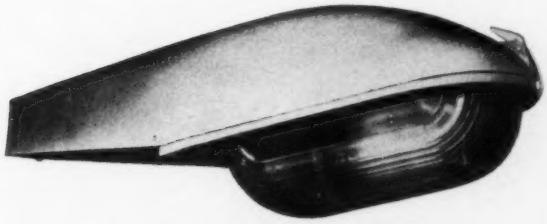


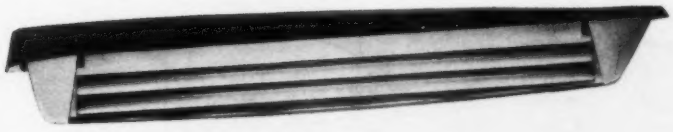
'HYPERION' SIDE-ENTRY LANTERN
For main road lighting, using 200 watt Sodium lamps of the linear or integral type.

LIGHTING



'HORIZON-MAJOR' SIDE-ENTRY LANTERN
For main road lighting using 250/400 watt MBF/U Colour Corrected or MA/V tubular Mercury lamps. Control gear housed in lantern body.

SERVICE



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For main road lighting, using two or three 5 ft. 80 watt MCF/U tubular Fluorescent lamps.

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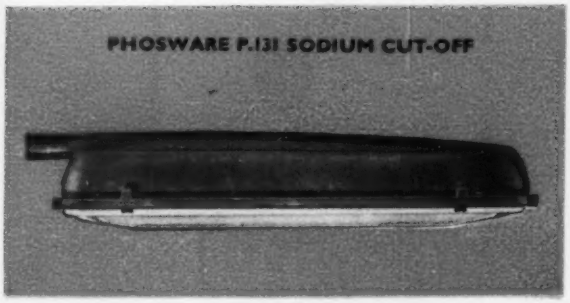

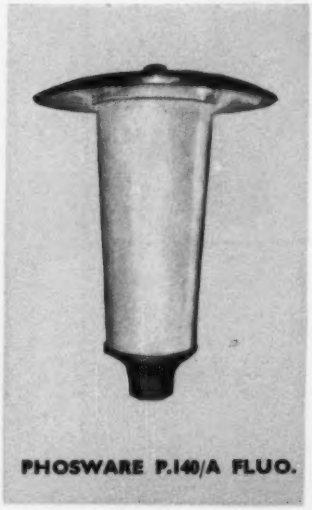

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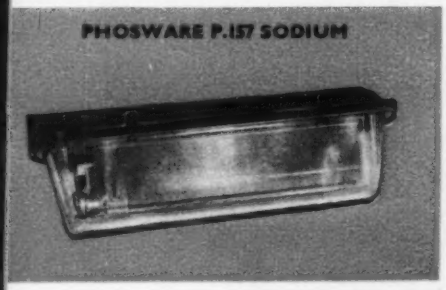

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POST-TOP

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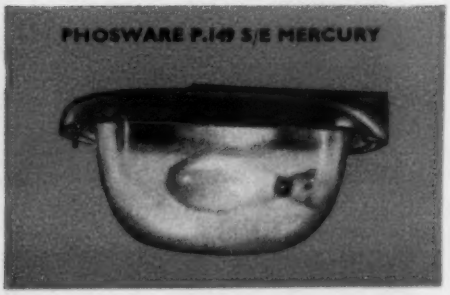


G.E.C. post top lanterns

give Birmingham's Inner Ring Road a new high standard of illumination

Lighting-up time in Birmingham will see a new standard of after dark safety on the city's 3¾ mile long 110 ft. wide dual carriageway ring road, already partly constructed.

An overall light intensity of at least 30,000 lumens was specified for the new road, this from lanterns spaced at 100 ft. intervals on the outer kerbs. To achieve this, Sir Herbert J. Manzoni, C.B.E., the City Engineer and Surveyor, called in the G.E.C. Lighting Division to develop his design for a new type of post-top lantern housing three 400w colour corrected mercury lamps.

This is the kind of combined operation the G.E.C. Lighting Division welcomes. It challenges its experience, advances still further its knowledge and makes another British road safe after lighting-up time.

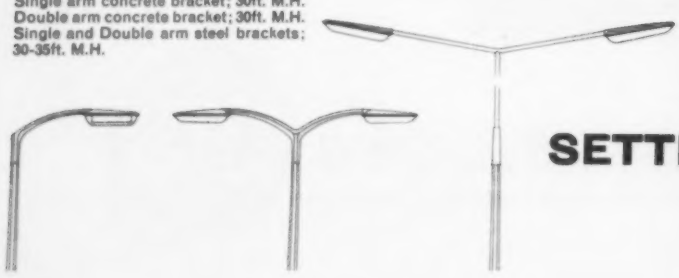
The specially designed post-top lanterns are 4 ft. 6 ins. in diameter, approximately 18 ins. deep, and consist of a domed canopy and dished translucent Perspex bowl. Access to the three Osram 400w colour corrected mercury lamps is remarkably simple. The 30 ft. high slender steel poles are made by Stewarts & Lloyds.

G.E.C. LIGHTING AND HEATING GROUP

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Photograph by courtesy of J. Woodhouse, D.P.A., Public Lighting Engineer, City of Sheffield.

The New Highway is available with:
Single arm concrete bracket; 30ft. M.H.
Double arm concrete bracket; 30ft. M.H.
Single and Double arm steel brackets; 30-35ft. M.H.



The New Highway column with tubular steel bracket for 30ft. mounting height has been chosen by the City of Sheffield for the new Parkway scheme; also by the Council of Industrial Design for inclusion in their South Bank Permanent Street Furniture Exhibition, as being one of the best designs available for high intensity street lighting requirements.

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Light and Lighting

Vol. 54 No. 12

Editor: G. F. COLE

Assistant Editor: D. B. WILLSON

CONTENTS

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Street lighting administration

Two important publications on street lighting have appeared in the last few weeks—the draft Code of Practice for traffic routes and the final report of the consultative committee on the lighting of traffic routes within the London conurbation. Both documents are no doubt being studied very carefully by street lighting engineers and lighting authorities. The techniques of street lighting, however, are bound to receive their full share of attention, particularly when the other sections of the Code, dealing with local traffic roads, town centres, bridges, tunnels, junctions, and even motorways, appear. We would, therefore, draw attention to an equally important aspect of street lighting, that of administration, which is in danger of being overlooked in the preoccupation with technicalities. This was a subject dealt with by Mr Lennox, who has now been advocating reform in this direction for many years, towards the end of his Presidential Address to the APLE Conference at Scarborough. The conurbation committees in London and a few other places in the country are about as far as we have got to organised co-operation between neighbouring lighting authorities; these committees, however, are concerned mainly with securing greater uniformity on main traffic routes. The problem of devising some means whereby costs can be more equitably divided amongst lighting authorities, or larger authorities created, remains unsolved. As Mr Lennox puts it, 'no hope of efficient schemes of uniform lighting of traffic routes can be entertained unless costs of lighting are administered in the same way as those of roads, education, etc.' Though this subject has been brought up many times over the years, as far as we know no concrete suggestions have been put forward. May we suggest that the APLE could very well tackle this task and submit a detailed scheme to the Minister; success would bring considerable credit to the Association.

Notes and News

THE CONSULTATIVE COMMITTEE on the lighting of traffic routes within the London Conurbation, which was the first such committee to be set up following the suggestion of the Minister of Transport and which held its first meeting in July 1958, issued its final report a few weeks ago. The committee issued an interim report in July 1959, since when it has concentrated its attention on the level of street lighting on all the main traffic routes in the Greater London area. In this work it collected information from 102 local authorities on existing street lighting installations and imminent improvements.

The committee is composed of representatives appointed by a number of local government bodies in the London area but includes no street lighting engineers though Dr Gillbe of the MOT acted as one of the honorary advisers. Its terms of reference include making recommendations to secure greater uniformity and continuity of lighting on traffic routes. This is taken to include uniformity of colour and one of the main recommendations is for sodium lighting to be used on what are called major traffic routes of primary importance (shown on a map included with the report). Uniformity of colour is not, however, considered to be as important as uniformity of level of illumination at which several of the recommendations are aimed. The recommendation of the interim report that no traffic route should be lit to less than 5,000 lumens per 100 ft linear of road is confirmed with a target of 10,000 lm for heavy traffic routes and 7,000 lm for medium traffic routes within three years. Many of the other recommendations were also made in the interim report.

One of the refreshing features of this report is that it was not written by people from the lighting industry and though some of the terms used may seem a little strange to lighting experts, on the whole it states its aims and conclusions in language which laymen will understand, though such phrases as 'the levels of illumination we have laid down' might be misinterpreted. Copies of the report can be obtained from the Honorary Secretary of the Committee, Mr B. H. Wilson, Town Clerk of Hampstead Borough Council.

Office lighting and legislation

WITH THE CAMPAIGN for better office lighting currently promoted by the BLC having got off to such a good start a month or so ago, there must have been keen disappointment that, contrary to expectation, the government did not make its announcement of legislation on the subject. Although the Offices Act 1960, which started life as the private member's Bill sponsored by Mr Richard Marsh, still comes in to force on January 1, little change in office conditions generally is likely to result. This Act merely empowers the Minister to introduce regulations specifying minimum requirements for lighting, sanitation and the like but, as we understand the situation, it was never the government's intention to introduce such regulations, pending further legislation dealing with a much wider range of premises than those covered in the Offices Act. As those who followed the Queen's speech, and the subsequent debate in the Commons, will have realised, this projected legislation has been crowded out of the current programme and will not now be introduced until the 1962-63 session. As the BLC has been quick to point out, this delay does not change the need for improved lighting in the thousands of offices which are as badly lit now as they were before the Queen's speech, and it is to be hoped that the sense of urgency created at the start of the campaign will not be allowed to evaporate. One thing is certain—if the regulations are as conservative as they usually are, lighting re-planned now to comply with the new IES Code will be equally sure to comply with them, whatever they may turn out to be.

Visit to the USA

WE UNDERSTAND a proposal has been made that the IES arrange a visit to enable members to see something of lighting activities in the USA. By taking advantage of charter flights for the crossing and assuming a full load of 100 passengers and a stay of three weeks (two weeks business, one week leisure) the basic cost per person would be about £200, of which part at least would probably be required in advance by way of deposit and might not therefore be returnable. Before embarking on the work involved in such a trip the Society would like to know to what extent such a trip would be supported. It is doubtful if such a trip could be arranged before the autumn of 1963. Any member who would seriously consider taking part is asked to inform the IES Secretary before January 8th, stating whether he would be accompanied by his wife.

Industrial Design in 1960

LAST MONTH saw the publication of the 16th Annual Report of the Council of Industrial Design; one of its principal features is a strong appeal for more design research of the kind that went into the CLASP school which won the premier award at the Twelfth Milan Triennale. Being seen to combine economy of means, strict attention to function, fulfilment of social needs, profitable production and architectural distinction, the school is regarded as demonstrating 'the

rewards of real, methodical design research of a kind all too rarely undertaken in this country'. The Council is particularly concerned with the British participation at the 1963 Triennale, since the problem will be to find examples of design to which the same fundamental research and development have been applied, 'for it is only through such rethinking of a product or programme that real achievement in design is certain'. An apathetic consuming public is, by inference, regarded as one of the root causes of the lack of improvement in design implied by the call for design research. For this reason, the Council welcomes the growing activities of the two main consumers' organisations in helping to create the critical, questioning public opinion required for design improvement. On the other hand, the growing number of visitors to the Design Centre —there were 893,000 in 1960/61 as against 688,000 in the previous year—seems to deny the implication of apathy. Moreover, the Council refers to several successful 'Design Centre visits' to provincial cities, of which the most ambitious was at Liverpool. Unlike other provincial displays, it was held in non-commercial premises, enabling shops and stores in the city to give it their full support; the attendance was 35,500. The Council is to intensify its approach to the retail trade and is also planning to step up its overseas activities.

The Lightmongers at Dinner

HELD FOR THE THIRD YEAR RUNNING in the Livery Hall of London's Guildhall, the Lightmongers' dinner last month was its usual convivial affair tempered by some pertinent comments from Dr W. E. Harper in proposing the toast to the Society. Examining the relations between the commercial and technical sides of the industry, he pointed out that one of the lighting industry's characteristics had been its technical vigour, which had resulted in much of the technical advance coming from within. If that vigour and initiative were not to be lost, bodies concerned with technical matters had to look to the commercial side for increasing support; if this were not forthcoming, the industry might see the initiative taken over by architects and electrical engineers. Stressing the value of an independent body to support the claims made by the industry for its products, he suggested that, as a comparatively small industry, it was burdened by too many technical bodies. He saw a good case for some 'elder statesmen' to undertake forward thinking in anticipation of the time when the industry could no longer afford the present number of organisations and was faced with the need for a single body speaking in its name. Other speakers were the President, Mr R. V. Stephens (who also presented cheques to the Royal Commercial Travellers' Schools and to the EIBA), Mr F. J. Burns and Mr C. Dykes Brown, who was inducted as the new President.

Xenon Lamp at Dungeness

THE XENON LAMP, with its compact size, high light output and ease of both optical and electrical control may ultimately bring about a revolution in the design and operation of lighthouses round our shores, if the new lighthouse at Dungeness, shortly to come into operation, is any guide. In contrast to the large rotating lens system, weighing up to five tons, and continuously burning paraffin vapour or tungsten filament light source, Dungeness has a 2 kw high pressure xenon arc discharge lamp just over 12 in. long and less than 2 lb in weight which is switched off and on instantaneously at the correct intervals so that the lens no longer needs to be rotated and becomes, in consequence, a comparatively simple prismatic drum. The substantial reduction in size and complexity of the optical system and lamp operating power has meant, for Dungeness at least, that the new tower need be no more than 12 ft in diameter which, with a height of 115 ft, gives a pleasing pencil slim appearance. It also means that the operation of the lamp may be supervised remote from the lantern platform, thus eliminating the need for permanent watch to be kept adjacent to the lantern throughout the period of operation; a reserve lamp and lens is mounted *in situ* in the lighthouse in case of emergency. Although Trinity House are planning to convert at least one other lighthouse to xenon lamp operation, it is perhaps a little early to think of this new light source as a revolutionary force. Where absolute reliability of the equipment is of such paramount importance for the safety of mariners, it is hardly surprising that the value of new developments must be proved beyond doubt before they come to be adopted to the extent which indicates a revolution. Dungeness is the first new lighthouse to be built in this country for fifty years and it may well be that another fifty years will have elapsed before xenon lamps can be regarded as the standard light source for lighthouses.

The AEI xenon discharge lamp and Chance Bros lens system for Dungeness lighthouse

Street Lighting Trends in the 60's

APLE Conference, Scarborough

THIS YEAR'S CONFERENCE of the Association of Public Lighting Engineers, held in Scarborough from October 3 to 6, will be remembered for several reasons, not least being that it was the Association's first visit to this holiday resort, made more delightful by the fine weather the Conference enjoyed. It was also the occasion of the new President's second term in that office, returning to it after a period of twenty-five years. Perhaps of greatest significance, however, was that the Conference was able to study the draft of the revised Code of Practice for the lighting of main traffic routes, which document had been specially made available by the British Standards Institution for that purpose. The recommendations for higher street standards put forward in the draft, coupled with the novel ideas expressed by authors during the Conference sessions gave this year's event a marked pre-occupation with trends in street lighting.

This Conference also differed from its predecessors in being held three weeks later in the year than has been usual, but without noticeable effect on attendance. Close on 1,100 members and delegates (including representatives from 340 local authorities) had registered and a high proportion of these turned up for the opening ceremony on Tuesday morning performed by the Mayor of Scarborough, Cllr W. H. Smith who welcomed the Conference to the town. This civic welcome was acknowledged by the retiring President Mr F. C. Smith in performing his last official duty in that office. He expressed his appreciation of the work of the Council and Staff of the Association during his presidental year, and went on to induct the new President, Mr E. C. Lennox.

In reply, Mr Lennox paid tribute to the work carried out by Mr Smith to the Association and expressed the thanks of all members to him. He then announced that Mr J. H. Morrison would continue as Vice-President in the coming year, and that the 1962 Conference would be in Blackpool, from September 18 to 21, under Mr Morrison's Presidency. He concluded the formal business of the meeting by presenting Certificates of Honorary Membership of the Association to Dr W. S. Stiles in recognition of his work on lighting, notably on disability glare and visual phenomena, and to Mr W. J. Jones for his service to lighting and in particular, his work in connection with public lighting, and then delivered his Presidential Address.

Street lighting over 25 years

It was natural that Mr Lennox, having previously been President twenty-five years ago, should devote his address largely to a survey of the changes between then and now, discussing how these changes indicated future trends. He reminded his audience that his first Presidency came at the beginning of a the publication of the interim report of the MOT Departmental Committee. This document, and the final report which followed it a year later, helped to create a general appreciation of the need for, and value of, better street lighting; it was also of material value to practising public lighting engineers and to lighting authority officials generally. However, with the intervention of the war and its aftermath of financial restrictions, street lighting engineers had had effectively only the decade since the publication of the Code of Practice CP1004, in which to develop street lighting on the lines set out in 1937. Yet those ten years had seen traffic density increasing to the point where lighting standards higher than those of the 1950 Code became necessary for certain roads.

He touched on the importance of skilled planning of installations and co-operation with highway engineers to ensure that road surfaces were selected to meet the dual requirements of skid resistance and light reflection and then went on to discuss road safety, pointing out that studies in the last few years had confirmed that both the rate and severity of night-time road accidents was reduced by good street lighting. It was agreed that legislation aimed at improving the behaviour of the driver should contribute towards reducing accidents but improvement in road conditions aimed at giving better visibility would produce better results in reduction of road accidents. Similar conclusions applied in the lighting of motorways: in France, it had been found that the installation of fixed lighting on the Autoroute de l'Ouest out of Paris had resulted in a 27 per cent reduction in the accident rate. Fixed lighting on motorways in this country would be worthwhile not only for the reduction of night-time accidents but also in permitting greater utilisation of the road.

Mr Lennox expressed little sympathy with the Transport Minister's refusal to light motorways whilst all-purpose roadways with heavy traffic remain unlighted, particularly when the reason for the lack of lighting on all-purpose traffic routes was the out-of-date administration of street lighting in this country. The main problem was the multiplicity of lighting authorities, of which three-quarters were too small to command anything like the financial resources required to execute their street lighting functions satisfactorily. The formation of Conurbation Committees for co-ordinating the lighting of traffic routes in extensive built-up areas had been of some value, but their usefulness was limited by their inability to deal with the problem of sharing the costs of lighting schemes between authorities. Some reform of administration generally was required to apportion equitably between high-income and low-income authorities the costs of street lighting made necessary by heavy traffic flow into and out of the centres of population and industry. Whilst such administrative reform would re-apportion costs, it could still leave operation of the lighting in the hands of the local authority.

New lamps or old?

Re-assembling on Tuesday afternoon, the Conference was treated to a dazzling lamp display by Mr H. Hewitt in the course of a comparative survey of lamps used for street lighting and flood-lighting. His excuse for the survey, and its necessary accompaniment of data on lamps costs and characteristics, was obsolescence; although this was something local authorities could not prevent, they might delay its effect (and lessen the resulting disappointment) by making sure that new installations were preceded by a thorough survey of available light sources in which due regard was paid to likely future developments. To this end, Mr Hewitt gave over the first part of his paper to establishing terms of reference for a comparative assessment local authorities might undertake, before presenting his own cost comparison based on those terms. The remainder of the paper provided survey of future developments in lamps for street lighting, followed by a brief review of lamp types used for flood-lighting.

In an economic comparison, lamp costs and energy costs could be determined easily, since the information required was readily available—the actual price paid for the lamp, including discount, its annual running time, its life, which was normally the nominal rated life but would be the actual life where group replacement was practised, its wattage and the watts loss of any control gear, and the electricity tariff. Labour costs, however, were less easy to determine for factual comparison. Mr Hewitt got round the difficulty nicely by arguing that as the chief element in labour cost was the life of the lamp (since this determined the number of replacements over a given period), the labour cost component could be ignored for discharge lamps because their lives were all either 4,000 or 5,000 hours which could not result in any great differences in replacement costs. If the comparison included incandescent lamps, however, the difference in labour costs became significant and allowance for it had to be made.

There were at least four indirect costs which ought also to be taken into account. The first was that of control gear; although regarded as part of the capital equipment, it was so vital an economic consideration that an annual allowance had been included in Mr Hewitt's comparison, based on a life of fifteen years. The need for housing the control gear might then influence the cost of lantern or column and in the same way, the type of lamp itself would also influence the cost of lantern. Finally, the cost of the lantern might be further influenced in the design of the optical system required by the lamp shape, size and brightness, as this would obviously bear on the 'lumens per point'—the criterion adopted by Mr Hewitt for his comparison.

The size and brightness of a lamp were, however, of much greater significance in the quality of lighting and were therefore of first importance in making a comparison of lamp suitability for a given type of installation. Mr Hewitt reiterated the basic principle that glare was a function of source area as well as brightness, to demonstrate that glare from an installation of tubular fluorescent lamps may, in fact, be greater than that from a sodium lamp installation. If, however, the tendency, because of dark road surfaces, was towards cut-off lighting then the problem of glare would be removed. On the other quality aspect, colour, Mr Hewitt was necessarily brief, in view of a later paper discussing this subject more fully.

Mr F. C. Smith (right) hands over to the new President, Mr E. C. Lennox, at the opening of the APLE Conference.

Having assessed these lamp characteristics, Mr Hewitt went on to make a cost comparison of lamp operation, making certain assumptions. He omitted certain lamps from the schedule, notable higher rating incandescent lamps (regarded as uneconomic) and uncorrected mercury discharge lamps of 80w and 125w, as these were now no longer cheaper than their colour-corrected counterparts. He derived annual costs for all other lamps used in street-lighting, but grouped them in four categories determined by lumen output per point, with the boundary line between each drawn arbitrarily; spacing and mounting height were excluded as criteria for classification since they were now more likely to be governed by glare and distribution than by quantity of light emitted. Mr Hewitt's categories and conclusions were:

Category 1: lamps giving up to 3,500 lm/point:
In this group the use of incandescent lamps had become economically untenable; if there was a job for the 100w tungsten lamp it could be done better by the 50w, MBF/U lamp, if simple, efficient and cheap lanterns could be produced. The tubular fluorescent lamp was seen to have a useful application in minor roads, given simple, efficient and cheap lanterns, and particular value was to be gained from the twin 30w lamp combination. He found it surprising that the sodium lamp had made such progress in minor road lighting.

Category 2: lamps giving from 3,500 to 7,000 lm/point:
Since it gave almost the same value as the 60w, SOI/H lamp for 4,000 hours burning, the 125w, MBF/U lamp was regarded as a good proposition for some of the minor roads served in this category. Moreover, the four 30w fluorescent lamp combination appeared to give good value, assuming an acceptable lantern cost, for 'important through minor' roads; the value of the twin 40w combination was seen as indicating the need for an appropriate lantern of reasonable price and good appearance.

Category 3: lamps giving from 7,000 to 15,000 lm/point:
The comparison again illustrated the inferior value of the orthodox sodium lamp; by comparison with the 140w, SO/H lamp, the 85w, SOI/H version gave better value for money although at a lower light output, and the 140w, SOI/H lamp gave a much higher output, and was regarded as having a useful role to play. The 250w, MBF/U lamp also gave a higher output but at slightly higher cost. On lamp

Mr H. Hewitt.

economics only, the three 80w tubular fluorescent lamp combination came out well and Mr Hewitt speculated on the outcome were a satisfactory and economic lantern to be evolved.

Category 4: lamps giving more than 15,000 lm/point: As in the previous category, Mr Hewitt could see little justification for using uncorrected mercury lamps when such good value and colour could be obtained from their colour-corrected counterparts. The sodium lamps stood out as giving good value for money, with the 200w, SOI/H lamp having the edge on the SOI/HL lamp of the same rating. For 'super roads', a twin 400w, MBF/U lamp combination offered more value all round than a single 700w, MBF/U lamp but where colour rendering was not important, the twin 200w, SOI/H lamp was superior.

Turning to some of the newer light sources, Mr Hewitt dismissed the 'high-loaded' fluorescent lamp as a possibility for street-lighting, even if it could be developed to have a 5,000 hour life. On the other hand, he saw some advantage to be gained by increasing the efficiency of tubular fluorescent lamps used for main road lighting at the expense of colour rendering, and contended that an admission of 15 per cent green content to the light would not be unacceptable. The iodine-filled quartz-tube tungsten lamp was also thought to have little possibilities for street-lighting, even as an integral ballast in a mercury lamp, although he suggested that a 100w source of 25 lm/w efficiency might be feasibie for category 1. The xenon lamp was regarded as being of little value outside those situations where a lot of light was required from a few sources mounted at great height to illuminate a large area.

Opening the discussion, Mr J. Pickup (Borough Polytechnic) said it was difficult to improve the light output ratio of lanterns for tubular fluorescent lamps without seriously affecting optical control, although this had been achieved in pole-top designs. He thought that sodium lighting did confer an improved visual performance, by giving a higher contrast sensitivity; as one of the effects of glare was a depression of contrast sensitivity, sodium lighting could, therefore, be said to produce less glare. The same light source also resulted in a more pleasing proportion of lantern to column. For city centres and similar areas, he doubted whether MBF lamps were really satisfactory and expressed a preference for tubular fluorescent lamps. This, however, raised difficulties in achieving the necessary lumen outputs required at the greater mounting heights now considered desirable for such roads. He was followed by Mr F. H. Pulvermacher (South Wales Electricity Board) who presented details of his own cost analysis (previously given in the September issue of *Light and Lighting*), the results of which agreed largely with those of Mr Hewitt's analysis; he also pointed out that lamp replacement costs might be significantly greater in 35 ft m.h. installations than in 25 ft installations.

Mr A. G. Penny (GEC) took up the question of obsolescence, emphasising that it was of much greater importance than Mr Hewitt had indicated and suggesting that he might have given greater thought to the difficulties presented by new developments. He suggested that the financing of installations was in need of reform to relate it more closely to the rate of technological development and he also felt that more attention should be given to developing lamps with integral optical control. Mr J. Wilson (Paisley) could not accept Mr Hewitt's figures for MBF/U lamps; he had been conducting an experiment in which he had found that by operating these lamps in a different manner, he was obtaining lives of 12,000 to 14,000 hours, and suggested that the Association should investigate and report.

Mr H. R. Ruff (AEI) commented that the extension of lighting for traffic routes in conurbations, and some other forms of lighting, required a lamp giving 20,000 lumens and these were also required for the relighting of traffic routes already lighted to earlier standards. Mr D. Clark (Norwich), pointing out that the nominal 1,200 lumens output of a 100w tungsten lamp was unlikely to be achieved in practice, urged that authorities contemplating conversion from gas should not choose tungsten lamps, despite the sales appeal of such features as extra long lives. Mr J. R. Brodie (Ayr) condemned sodium lighting; he said it had been introduced at a time when the country was suffering from economic privation but such conditions no longer applied. Street lighting should try to imitate daylight, with colour rendering being given first priority.

Annual Luncheon

The APLE's Annual Luncheon, held on Wednesday, was a somewhat shorter event than usual, the programme being conditioned by the fact that, instead of having a free afternoon, delegates were to discuss the draft revision of the Code of Practice. The speeches were opened by Mr J. H. Morrison, who proposed 'The Corporation of Scarborough and The Guests', to which the Mayor replied. The toast to the Association was proposed by Mr C. T. Melling, Deputy Chairman of the Electricity Council, who said that the APLE conference was an important one and the growth of public lighting over the years spoke well for it. When lighting was such an essential part of roads and road use it was not enough for the public to call only for more roads and motorways. Lighting was vitally important to safety; the country could not afford to tolerate the present accident rate when lighting could do so much to reduce it. He was sure the Association was right to press for the lighting of motorways. In reply, Mr Lennox said the deep interest in public lighting of those leading the electricity supply industry reflected their desire to give the best service to consumers, ratepayers and users. He was sure that the new efficiencies in light production would not be wasted, but would be used to give more light on the highways.

The revised Code of Practice

It was a situation probably without precedent when the Conference re-assembled on Wednesday afternoon to discuss the draft of the revised Code of Practice for street lighting, but as the delegates had had only about twenty-four hours in which to study the document it was perhaps hardly surprising, if a little disappointing, that the discussion did not achieve the standard some had anticipated. The Association had assembled an impressive team to answer questions on the draft—G. Grime (Road Research Laboratory), W. Robinson (Electrical Development Association) and Granville Berry (Coventry City Engineer)—under the Chairmanship of F. C. Smith who introduced Mr Grime to present the salient features of the revision.

(continued on page 361)

STREET LIGHTING INSTALLATIONS

The last year has seen a growth in the number of street lighting installations using 200w sodium lamps; the upper three of the four installations depicted on this page are of that character, and are all major traffic routes.

The top picture shows part of the A453 Birmingham to Nottingham double-carriageway trunk road at Sutton Coldfield, where an installation of 200w, SOI/HL lamps in cut-off lanterns has been in operation for the last six months. A total of 56 such lanterns, supplied by the GEC, have been installed, on 30 ft Stewarts and Lloyds steel columns fitted with 5 ft outreach brackets. The columns are spaced at 90 ft opposite; each carriageway is 22 ft wide and surfaced in tarmac. The installation was designed in co-operation with Mr T. Porter, Borough Engineer and Surveyor of Sutton Coldfield.

The picture at centre, ieft, shows part of the A48 Cardiff to Newport road at St Mellons. The lighting of a five and a half mile stretch of this road for the Magor and St Mellons RDC was completed recently by AEI, who supplied and erected 180 'Amberline' non-cut-off lanterns on Stewarts and Lloyds 35 ft steel columns with bracket outreaches varying between 6 ft and 9 ft. This installation is particularly significant in being one of the first to be approved by the Ministry of Transport for a road running through a non-built-up area and it is suggested as being a forerunner of similar schemes on important inter-town roads passing through largely open country. Such is the traffic density on this road (the peak is greater than 2,000 vehicles per hour) that lighting was considered essential for the safety of road users and of the police for night-time traffic control at accidents. It is a four-lane road, 40 ft wide, and columns are spaced at intervals of 170 ft, staggered, giving 10,000 lm/100 ft linear. The scheme was planned by the MoT and Mr H. Roberts, the RDC Surveyor, and erection carried out by S. A. Inston and Co Ltd.

Centre, right, shows part of a 35 ft wide traffic route at Romford where Atlas supplied sixty-nine 'Alpha Five' lanterns. These have been installed on existing Stewarts and Lloyds columns spaced 140 ft apart and whose height was increased from 25 ft to 30 ft by conversion brackets with minimum outreach.

The fourth illustration, at foot of page, shows part of the town centre at Leicester, where amenity considerations indicated the use of a light source with good colour rendering. Here Revo 'Halcyon' lanterns for three 5 ft, 80w fluorescent lamps have been mounted at 25 ft on building walls and steel columns. These lanterns are of resin-bonded glass-fibre body construction thus reducing both weight and maintenance.

STREET LIGHTING INSTALLATIONS

continued

It is now generally accepted that the daylight appearance of street lighting schemes is virtually as important in its relation to the environment of the installation as the night-time effect in making roads safer and, as shown on this page, manufacturers of columns and lanterns have achieved considerable success in creating pleasing aesthetic designs which combine harmoniously in actual installations.

Top left depicts an installation of Atlas 'Alpha Three' lanterns and Stewarts and Lloyds fluted columns at Feltham; the lanterns are fitted with aeroscreens made necessary by the proximity of London Airport. A total of 172 lanterns was installed, each housing a 250w MBF/U colour-corrected mercury lamp. The columns are spaced at 110 ft, staggered, giving 10,000 lm/100 ft linear, and the road width is 40 ft.

Top right shows an installation at another outer London suburb—Wembley. This is a trial installation, in Fryent Way, which is now to be extended; the lanterns are Eleco 'Golden Ray 200' using 200w, SOI/H lamps mounted at 30 ft on 'Elecoslim' concrete columns fitted with steel extension brackets to achieve the required mounting height.

The centre picture shows Kingsway, Cardiff, as it now appears after the installation of GEC post-top lanterns on 25 ft concrete columns. As at Leicester, the nature of the environment obviously required a light source with good colour rendering and each lantern houses four 5 ft, 80w, MCF/U lamps.

Bottom left shows another Revo installation at Leicester, this being of their 'Hyperion' lanterns installed at 30 ft on Stewarts and Lloyds steel columns. This is a good example of the 'whip' column design which requires for its effect a lantern having the slimness which characterises this particular lantern.

Bottom right shows a contrasting method of obtaining a comparatively long outreach. This installation, on Sheffield's new 'Parkway', is of Eleco 'Golden Ray 200' lanterns mounted on Concrete Utilities' 'New Highway' concrete column, which, with the extension bracket, gives a mounting height of 35 ft. The column-bracket joint is sealed by a resin-bonded glass-fibre shroud whose proportions go some way to masking the discontinuity at this point. Sheffield 'Parkway' will be widened to double carriageway in about four years' time when those columns now sited in what will become the central reservation will be removed and re-erected opposite those on the other side. The present scheme, of 28 units spaced at 120 to 140 ft, extends over two miles.

Mr Grime started by admitting that, at first sight, the new document with its fifteen tables might appear complicated; there was, in fact, an essentially simple basis for the tables and they were developed logically and naturally from those parts of the old code which they were intended to replace. He also pointed out that the new document, which was a revision of Part I only of the old code, was therefore concerned solely with traffic routes. It did not depart from the basic principles of the old code so much as expand them, and present a different manner of specifying the parameters of an installation. The three-fold growth in traffic, and the gradual change in road surface character which had occurred in the last twenty-five years, had necessitated the changes in the technique of lighting now reflected in the revision. The principal alterations which had been made were to replace the original single classification for traffic routes by three new classifications, to introduce four mounting heights, to cater for reduced spacing in certain circumstances, and to specify only medium-angle distributions for non-cut-off installations.

The new classifications which had been introduced to raise the standard of traffic route lighting were:

Group A1, for principal through roads (trunk and major Class I roads); it corresponded to a distinctly higher level of lighting than the original Group A, having a greater lower-hemisphere light flux and an upper limit of 4 to the spacing-height ratio, as against 4·4 to 4·8 of the old Group A.

Group A2, for other through routes (Class I roads not included in Group A1 and important Class II roads); it corresponded to the upper part of the former Group A.

Group A3, for minor routes carrying more than purely local traffic; it corresponded to the lower part of the former Group A.

Associated with the new classifications were four mounting heights of 25, 30, 35 and 40 ft, although not all were used in Groups A2 and A3. The idea behind this range of mounting heights and their associated spacings was to provide a basic installation geometry giving the familiar 'T' brightness pattern which would be repeated at each combination of light output, mounting height and spacing required for different road widths. Provision was, however, made to cater for increased road widths solely by reduced spacing up to certain limits determined by the need to maintain the required visibility over the whole road.

The restriction on lantern distribution had been imposed to minimise glare; although the road brightness pattern achieved from high-angle distribution did not differ markedly from that from medium-angle distribution the glare was much greater. In order to make it easier to recognise and specify, medium-angle distribution had been defined and limits set to the intensities at certain angles: the requirements for lanterns using high-pressure mercury or filament lamps were slightly more stringent than for those using sodium lamps, whilst for lanterns using tubular fluorescent lamps certain requirements were relaxed. In general, the recommendations were designed to give results with road surfaces which were neither unduly dark nor unduly matt; with a dark matt surface the installation should be generously designed. Mr Grime then went on to describe in greater detail specific types of arrangement and their associated tables giving recommended combinations of mounting height and spacing for a range of road widths.

Mr J. H. Morrison (Vice-President, APLE) speaking during the Annual Lunch; from left to right are seen Cllr. W. H. Smith (Mayor of Scarborough), Mr Lennox, Mr C. T. Melling (Deputy Chairman, Electricity Council).

(Apart from the new classifications for traffic routes, the draft also indicates that there will be a new third Group of installations—Group C. This is divided into five lighting classifications: town and city centres, bridges and flyovers, tunnels and underpasses, roundabouts and complex junctions and roads with special requirements in which are included motorways, and roads near airfields, railways and docks. The two classifications of Group B installations, differentiated according to the layout of road and surrounds, are retained.)

Mr Berry underlined some of Mr Grime's comments, emphasising the one-in-three reduction in accident rate which good light achieved, and arguing that the higher standards recommended were sure to give even better results. Of road surfaces, he said that, whilst co-operation between highway engineers and lighting engineers was good in principle, the paramount characteristic of a road surface was its skid resistance, and this quality should not be made subject to the desire for good light-reflecting properties.

Opening the discussion on the draft, Mr R. Stevens (Atlas Lighting) welcomed the attempt to define the photometric performance of lanterns more accurately but he wondered what tolerances were placed on the figures specified and on what basis the figures themselves had been derived. Perhaps the best solution would be to make the Code's requirements target figures for lanterns, and to specify tolerances in a separate document. He felt that, with the high levels of illumination being generally provided nowadays, there was no longer the need to specify performance to the same close tolerances as were necessary when lamp efficiencies and outputs were much lower. In reply, Mr Robinson pointed out that the draft was presented for comment and it was hoped to obtain the views of industry on this subject; Mr Grime commented that the requirements were not new and differed only slightly from the requirements for medium-angle lanterns laid down in the old code. The Drafting Committee, after having examined many installations, was convinced that the requirements were still necessary.

Mr A. L. Percy (Huddersfield) thought that not enough attention had been paid to roundabouts, particularly in devising a form of lighting which was clearly indentifiable from some distance as indicating the presence of a roundabout ahead. He suggested an array of vertical fluorescent tube lanterns across the central island. Mr Robinson, replying, said that whilst the section on roundabouts stressed the importance of providing unambiguous identification,

Mr J. T. Grundy.

the recommendations on this subject were necessarily brief because the Committee had not yet had time to formulate definite ideas and for that reason welcomed every suggestion.

Mr J. C. Cotton (Portsmouth) thought the draft's recommendation to avoid the use of dark, rough surfaces was unrealistic and should be omitted; he asked what importance the Committee attached to the colour of a surface as he had always understood that texture was the most significant optical factor. Mr Grime said that the recommendation reflected the Committee's views that whilst it was not possible to avoid using surfaces which were not ideal, the worst surfaces, which formed only a small proportion of the total anyway, could be avoided. The colour of a surface was becoming significant because the head of the bright patch on the road was now assuming more importance relative to the tail.

Ald P. H. Renwick (Newcastle-upon-Tyne) expressed concern at the cost of these higher-standard installations and thought the Government should devote some of the road fund for lighting. Mr Berry commented that, although this was a policy matter for elected representatives, the sooner the Minister of Transport was persuaded to include street lighting in the classified grant, the sooner would the relighting of British roads be completed.

Mr M. W. Hime (South Eastern Electricity Board) expressed disappointment that the draft fixed a maximum mounting height at only 40 ft; he felt that, if the Code was to cater for the next decade or so, this limit would be inadequate. Mr P. V. Marchant (Wandsworth) said guidance should have been given on the high-lighting of pedestrian crossings. Other subjects which speakers felt should have been included were colour differentiation between traffic routes and other roads, and unformity between existing Group A lighting and new installations designed to the high standards now indicated. In the last contribution, Mr A. H. Nash (AEI) suggested that the draft should give clearer guidance on the choice of cut-off or non-cut-off distribution for a given road surface; manufacturers would like to be able to anticipate more accurately the demands for either type.

Colour and its problems

Whilst provision of ample light economically is still the main function of street-lighting, its colour is engaging more and more attention from authorities and road users, as exemplified by the close interest of the Conference in Thursday morning's paper, 'Colour is no bar' by J. T. Grundy and G. K. Lambert. It aroused considerable discussion and sparked off a lively controversy over sodium lighting.

Mr G. K. Lambert.

Before discussing the effect or use of colour in street lighting, the authors set out to answer the seemingly simple question—what is colour? Aided by a variety of ingenious demonstrations, they took their audience through the complexities of the nature of light, the CIE chromaticity chart, colour appearance, colour rendering, and the perception of light and colour, touching on the effects of brightness level, surface character, source size and location and the inter-relation of speed of seeing and persistence of vision. Most complex was the mental interpretation of what is 'seen'; the brain scanned the nerve signals generated at the retina by the photographic image formed thereon, but the picture finally created in the mind also owed a great deal to previous experience and knowledge. It was only when the particular scene or component of that scene was viewed in isolation that the brain was deprived of preconception and could therefore be deceived. So long as the observer was in circumstances which were familiar or real, or imparted such senses, his mind could be stimulated by the minimum of colour in the visual scene.

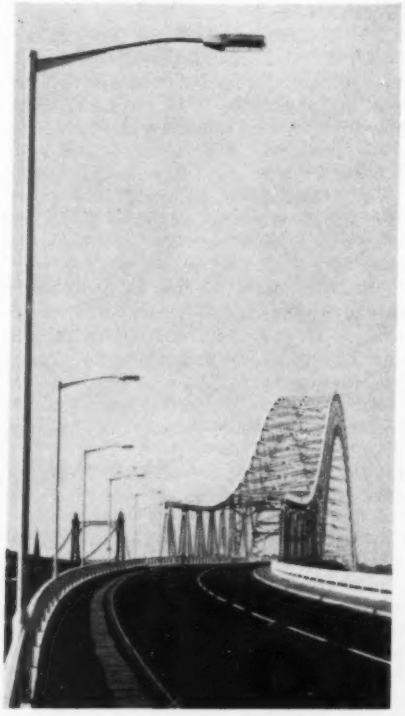
Turning to street lighting, the authors pointed out that the illumination levels achieved in most present day schemes resulted in brightnesses well below those at which colour was fully apparent, since they fell within the range in which the Purkinje effect occurred. Moreover, specular reflections and shadows masked much of the surfaces which could have been seen in colour. What was noticed more was the colour of the lighting unit and this assumed greater importance than the appearance of surfaces; a colour quality very much less than that demanded for interiors was all that was justified.

The authors pointed to the long history of investigation into the properties of light produced by incandescence and by discharges in various metallic or gaseous vapours, and referred to de Boer's recent series of extensive laboratory and field trials which showed that for equal visibility, at 300 ft, of 6 in. square test objects, half as much more light was required from corrected mercury lamps as from sodium lamps, that a sodium lantern may have 1½ times the brightness of a mercury lantern for equal glare and that for an equal impression of brightness, a surface lit by colour-corrected mercury lamps needed to have a luminance 30 per cent greater than when lit by sodium lamps. The authors also cited other work to show that, generally, sodium lamps were found to be less bright and glaring than mercury lamps of equal luminance, and that they produced better visibility of objects in an installation, other factors (notably lantern brightness, flashing and distribution) being equal; further studies had demonstrated that, where brightness contrasts exist, their enhancement under sodium lighting was significantly greater than occurred under mercury lighting, and that visual acuity was also improved. These investigations agreed in attributing to sodium light characteristics due to its spectral energy distribution which gave it an effectiveness for street-lighting unequalled by other practical light sources.

It was argued that, in visible confirmation of these qualities, sodium lamps had been used in the lighting of all kinds of roads; in certain places, they had been employed in combination with other light sources to give some colour improvement. The authors contended that such improvement should be aimed at the appearance of the source; the light had to be mixed in the lantern. To this end, incandescent filament lamps, whilst adding a continuum containing a high proportion of red, offered disadvantages of short life and low efficiency. Colour-corrected mercury lamps for the same purpose had the advantage of adding more visible blue to balance the yellow of the sodium but the resultant colour of the mixture might not be attractive and, in view of the linear shape of the sodium source, the bulbous shape of the MBF source facilitated neither colour mixing nor light control. The solution they advocated was the admixture of tubular fluorescent lamps of blue-green colour with sodium lamps and some ideas for pole-top diffusing lanterns executing this function were demonstrated. The combination was said to offer high efficiency and effective mixing and, with the

STREET LIGHTING INSTALLATIONS

continued



Road improvements in the last year have included four major schemes designed to eliminate points of serious traffic delays—the bridge over the River Mersey between Widnes and Runcorn, the bridge over the River Tamar between Plymouth and Saltash, the fly-under on the Western Avenue (A40) at Hanger Lane, and the fly-over on the Great West Road (A4) at Hammersmith. All four schemes involve street lighting installations of which three are depicted here; unfortunately the Hammersmith fly-over was completed too late for us to include details.

Illustrated above, the Hanger Lane underpass, 780 ft long, is virtually a tunnel and hence introduces the problem presented by tunnels of improving visibility in the tunnel mouth for daylight adapted motorists approaching it. The problem is overcome at Hanger Lane by a special louvered canopy erected for a distance of 220 ft across each approach cutting, successively reducing the amount of daylight falling on the road surface and thus gradually reducing the adaptation level. Within the tunnel lighting is provided from special cornice lanterns housing one 5 ft 80w fluorescent tube. After dark the cuttings are lighted by cut-off lanterns mounted at 25 ft and housing 400w MBF/U lamps whilst the approach roads have the same light source in medium-angle lanterns. The complete lighting scheme (for day and night) was evolved by the GEC.

The same lighting firm was also responsible for the lighting of the Tamar Bridge, the country's longest suspension bridge, which is shown in the two pictures below. The total suspended length is 1,848 ft. The lighting, on both bridge and approaches, is provided from 75 GEC non-cut-off lanterns housing a 200w linear sodium lamp. On the bridge itself, they are mounted on 25 ft steel columns built into the handrail structure and spaced at 90 ft; on the approach roads they are mounted on 30 and 35 ft columns. The joint authority was the Plymouth City and Cornwall County Councils.

The Mersey Bridge, shown left, is also a record, being Europe's largest span bridge, with a central steel arch span of 1,082 ft. The bridge and its approaches are lighted by Atlas 'Alpha One' sodium lanterns mounted on 25 ft steel columns. Design and erection were supervised by the Borough Engineers of Runcorn and Widnes.

Mr Morrison, Mr Lennox, Cllr Smith and Mr E. Evans (Secretary, APLE) being shown a new fitting by Mr W. T. Souter (Chairman, Holophane Ltd) during the tour of the exhibition.

proportions of the two colours determined correctly using the Maxwell centre of gravity mixing rule, colour rendering at the brightness of street lighting were considered acceptable.

This combination was seen as a means to improve appearance for those areas where it was required to take advantage of the virtues of sodium lighting but where amenity indicated the need to improve colour appearance; the authors admitted that the best colour appearance, and colour rendering, was provided by tubular fluorescent lamps but they felt that such sources were used to best advantage (particularly in multi-lamp assemblies) in wall-mounted cut-off lanterns, although the modern, slim, column-mounted lantern had produced excellent results.

The discussion was opened by Dr D. H. Fender (Reading University) who, in complimenting the authors on a paper which would not have disgraced the Royal Institution, expressed support for the view that national resources were such as to support higher standard and better quality street lighting. The main disadvantage of street lighting was that it created the brightness values (0·1 to 1 ft-L) at which the eye changed from photopic to scotopic vision; over this range, human colour sensitivity fell rapidly and apparent brightnesses were changing value. It seemed to him to be essential to avoid conditions in which sensing mechanisms were subject to such rapid and marked changes and the aim should be, therefore, to improve conditions so that they lay as much as possible outside this range. The same consideration applied to colour and brightness reaction times, which lengthened markedly in the photopic-scotopic range and it was then quite possible for reaction time to change from $\frac{1}{4}$ to $\frac{3}{4}$ seconds.

The discussion was continued by the Hon Vere Elliott (Westminster) who regretted the emphasis on the use of sodium lighting. His own authority were pursuing a modernisation scheme based on fluorescent lighting despite its high capital costs; the important thing was to preserve the appearance of building frontages and of ratepayers. He also regretted the seeming reliance on light spill from shop windows, urging that the aim was to ensure the whole road was lighted the whole of the time without making use of any extraneous light which happened to be present. Mr F. Widnall (AEI) felt that the idea of two light sources in one lantern was an unhappy compromise. He wondered whether this partial colour correction was not dodging the more fundamental problem of working out a solution to the real need for a better amenity standard, particularly in residential roads. Mr H. F. Cork (Manchester) expressed his belief in the suitability of sodium lighting for built-up areas, but said that it created a problem in that pedestrian crossings did not stand out well; his experience was that local high-intensity lighting with tungsten or mercury lamps was no solution and suggested it might be better to change the colour of the street lighting installation in the vicinity of each crossing to give warning to motorists of an approaching hazard.

Mr Brody (Ayr) vehemently re-affirmed his opposition to sodium lighting and thought that the present 'pause' in capital expenditure provided a good opportunity to revise present ideas in view of the way street lighting would develop in the next ten years. Dr H. H. Ballin (Atlas Lighting) was not sure that colour appearance of the light sources was always more important than their colour rendering, particularly in civic centres and was sure that the admixture of two bad colour sources was no answer to the problem of finding a good colour source. Mr D. W. Smith (British Luma), referring to the photopic-scotopic change-over, thought that the authors had not anticipated sufficiently the future tendency for street lighting schemes to be much more generously designed, providing for direct rather than silhouette vision in which colour appreciation would assume greater significance. Referring to the way the efficiency of colour-corrected mercury lamps had been increased in the last year or two, he saw no basic reason why this trend should not continue, possibly quite significantly, to reach the point where these lamps became at least as economically attractive as sodium. The argument was pursued by Mr C. C. Smith (Liverpool) who pointed out that silhouette vision was originally chosen as the basis for design on economic grounds; if colour was to become more important, it would be necessary to design to higher brightnesses which would be much more expensive. This should be accepted in the lighting of civic centres but did not necessarily apply to traffic routes.

Open Forum

On Thursday afternoon, the Conference repeated last year's innovation of an open forum, in which delegates were invited to submit questions on any aspect of street lighting to a panel of six—Cllr A. Brown (Chairman, Leeds Street Lighting Committee), H. M. Ferguson (Hirst Research Centre, GEC), P. V. Marchant (Wandsworth Borough Engineer), B. C. Ossitt (Lighting Engineer, SEEB), H. J. Slater (Nottingham Lighting Engineer) and W. T. Souter (Chairman, Holophane Ltd), with the President in the chair. The questions ranged over a variety of subjects, ranging from fluorescence to frequency of patrolling street lighting installations. This latter, incidentally, provoked two apparently contrasting views: one panel member thought that, for a discharge-lamp installation, once or twice a fortnight was adequate; another thought that traffic routes should be patrolled nightly but that, for side roads, it was either sufficient to rely on householders to report lamp failures or advisable to adopt group replacement.

The panel was asked whether authorities were being reasonably treated in the price they paid for electricity when 80 per cent of the street lighting load lay outside the peak periods; Mr Ossitt pointed out that as the street lighting load did impinge on the peak, then the maximum demand of

that load during that time had to be paid for. The old problem of vandalism was also raised: if street lighting was now so important in the reduction of accidents, was it not time that magistrates took a more serious view of malicious damage? In a reply which showed this to be a particularly frustrating problem, it was pointed out that there were limitations in the law which resulted in the penalties imposed being too small to be an effective deterrent. It seemed that some success had been achieved by increasing mounting heights and by leaving lamps unlit for a time following outbreaks of malicious damage.

Question was raised whether the development of the colour-corrected fluorescent-bulb mercury lamp was now such as to supersede the tubular fluorescent lamp for street lighting, and whether there were not now too many light sources anyway. On the first question, Mr Souter pointed out that whilst the more compact size of the MBF lamp seemed to confer some advantages for lantern design, it might present difficulties for the non-cut-off lantern specified in the new draft code. On the other hand, design of lanterns for tubular lamps had improved recently, and multi-lamp lanterns offered the facility of half-night reduction. On the other question Mr Ferguson said he could see no reason for continuing with 80w and 125w, MB lamps as their MBF counterparts, now at the same price, gave more light of better colour. He also suggested dropping detachable-jacket sodium lamps in favour of integral vacuum-jacket versions; the detachable-jacket lamps offered perhaps a saving of 1*s.* per point per year, at the cost of gradually deteriorating light output.

Socio-economic aspects

In the concluding paper of the Conference, Mr E. B. Sawyer presented a closely-argued case for doubling up on street-lighting expenditure to provide the community in the shortest possible time with lighting offering the maximum amenity and functional value in terms of increased road utilisation and reduced accident rate. By quoting evidence from a variety of sources he showed that roads goods transport has become the principal method of conveying materials and manufactured goods internally and that 80 per cent of all passenger surface travel was now by road transport, of which 60 per cent consisted of cars used wholly or partly for commercial, business or professional purposes. From this evidence he deduced that if the roads were not to become completely saturated, their hours of use had to be considerably extended.

He pointed to statistical evidence which showed that the speeding up of traffic in good street lighting was also accompanied by a reduction in accidents and then pursued this argument to conclude that the saving on good street lighting resulting from an increase in traffic speed of 1 mph would be £4 million annually. He then went on to discuss accidents and, from a comparison with industrial accidents, concluded that the total economic costs of road accidents could not be less than £150 million annually. In an examination of the traffic problem, he concluded that traffic in five or six years time will approach 90 per cent of capacity on trunk roads and 65 per cent of capacity on Class I roads; about half the traffic fatalities will be in rural areas. The cost of modernising our roads system to make it fit for the traffic growth was going to be enormous; Mr Sawyer indicated that £1,000 million had to be appropriated for works in London, county boroughs, boroughs and urban districts; in addition, there were 800 miles of motorway required, together with the replacement of 1,000 miles of trunk roads by motorways and the modernisation of a further 6,000 miles of trunk roads and 20,000 miles of Class I roads. The cost would be of the order of £3,700 million towards which the Government were spending £230 million in the next three years. Against these figures, the cost of providing street-lighting of a really advanced nature seemed fairly insignificant.

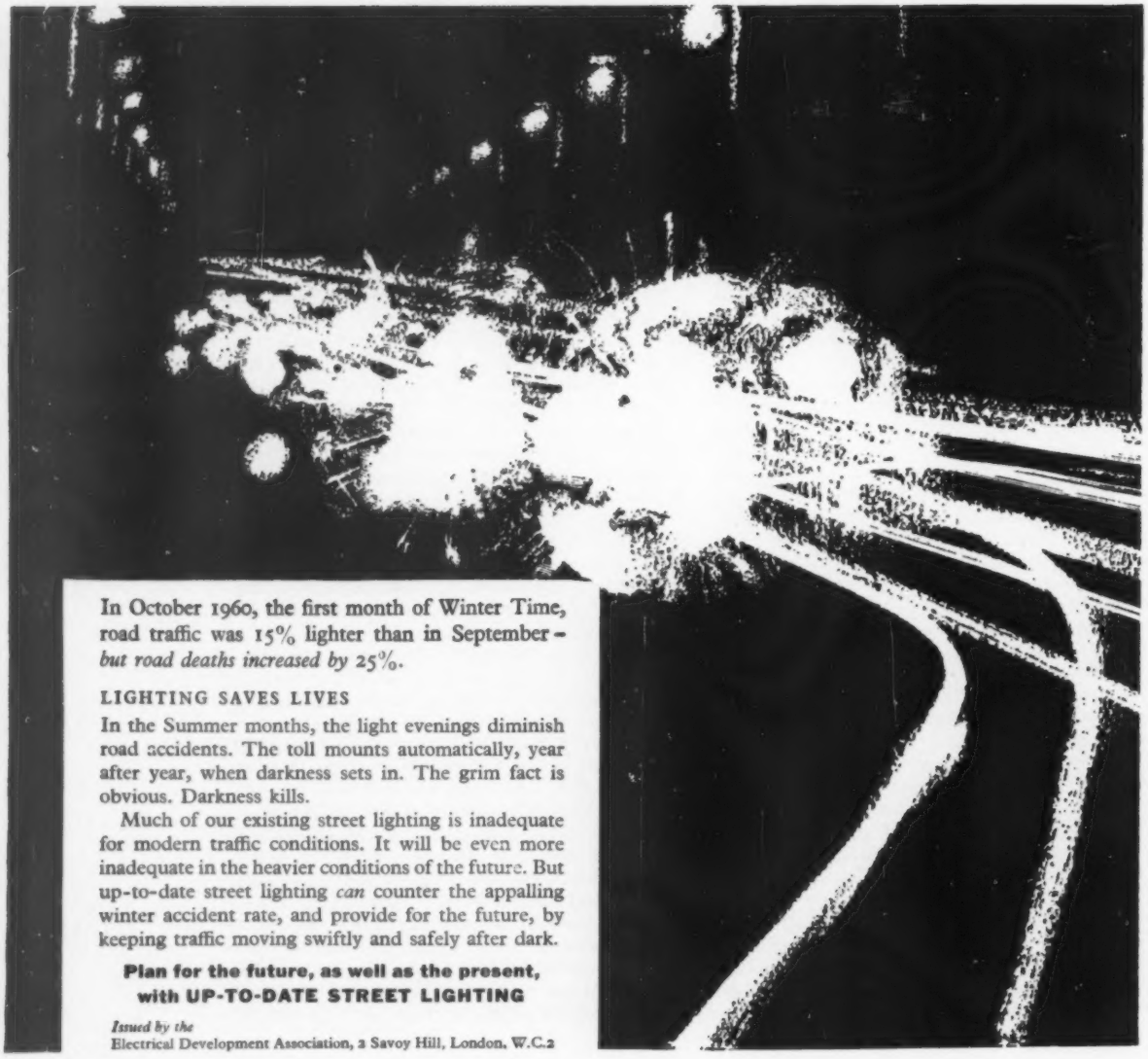
At present there were 10,000 miles of trunk and Class I roads with some form of street-lighting, leaving 16,000 miles of important roads unlighted. Because of the genuine inability of some local authorities to pay for what was required, and the lack of appreciation by others of the potential of, and need for, new lighting, progress lagged behind that which was technically possible. The standard for every traffic route on which traffic equals the design capacity should be such as to impose no greater strain on the driver and no greater uncertainty on the pedestrian than experienced by day.

By the next ten years, Mr Sawyer anticipated that all trunk roads in urban and many rural districts would be lighted to a standard of about 20,000 lm/100 ft linear, with 90 per cent of urban and 40 per cent of rural, Class I roads lit to a slightly lower standard and another 5 per cent of rural trunk and Class I roads lit to the present Group A standard. This would cost £115 million, and the annual cost at present values would rise to £46 million. On this basis, the consumption of electricity would be about 2,000 million units annually, which agreed with the figure estimated by assuming that growth continued at its present rate. Traffic density was, however, increasing at the same rate and the present unsatisfactory and dangerous state was likely, therefore, to remain, and the answer, as Mr Sawyer saw it, is to step up the expenditure on street lighting by at least as much again to overtake the traffic growth in as short a time as possible. Good lighting, he concluded, will save about £60 million per year on the present cost of casualties, damage and loss of time. Local authorities were already spending £30 million per annum on their public lighting, and if this were doubled the whole programme could be completed in about four years.

Mr J. W. Dorrington (Coventry) said that the most important figure in the paper was the 30 per cent accident rate reduction which good street lighting achieved; as this had been arrived at under the present Group A lighting he was sure that the higher standards now advocated would result in greater reduction. He agreed that it would be desirable for all classified roads to be lighted but this would place an impossible burden on lighting authorities. The lack of an improvement grant covering lighting was delaying the work being carried out and the time was long overdue when the Ministry should bear the whole cost of trunk road lighting. Ald J. W. Perkins (Surbiton) urged care in the use of arguments for better street lighting, particularly when most accidents occurred, after all, during daylight. He also supported the view that the lighting of trunk roads was a national responsibility. Cllr F. Keating (Liverpool) thought there might have been more attention to social aspects and said that importance of street lighting in deterring and reducing criminal assault should be stressed as a means of support from the public.

Mr E. B. Sawyer.

DARKNESS is a killer



In October 1960, the first month of Winter Time, road traffic was 15% lighter than in September – *but road deaths increased by* 25%.

LIGHTING SAVES LIVES

In the Summer months, the light evenings diminish road accidents. The toll mounts automatically, year after year, when darkness sets in. The grim fact is obvious. Darkness kills.

Much of our existing street lighting is inadequate for modern traffic conditions. It will be even more inadequate in the heavier conditions of the future. But up-to-date street lighting *can* counter the appalling winter accident rate, and provide for the future, by keeping traffic moving swiftly and safely after dark.

Plan for the future, as well as the present, with UP-TO-DATE STREET LIGHTING

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STREET LIGHTING TRENDS

APLE Exhibition of Public Lighting Equipment

THE PRE-OCCUPATION with future trends which characterised the APLE Conference was also reflected in the Exhibition, but less markedly so, in the sense that the indecision which seemed to hover over last year's exhibition was no longer present, having been replaced by more precise guidance on the form of future development in the draft of the new Code of Practice. There was more attention being paid to ways of using the high power light sources which will be embraced by the revised Code of Practice for traffic routes when it appears in its final form but there were also some developments for minor roads, all, however indicative of concern for the more immediate future rather than for long-term trends.

Lamp developments

To demonstrate that possibilities for further exploiting the sodium lamp have by no means been exhausted, Mazda and Osram showed an interesting development in a linear version of the 60w lamp, which, like its 200w brother, has a 100 lm/w initial efficiency and a life efficiency of 92 lm/w. This gives it a light output approximately the same as that from a conventionally shaped 85w sodium lamp of integral construction. The AEI development employed an arc tube about 12 in. long, enclosed in an integral vacuum jacket with two internal heat shields; electrically, it has been designed for minimum electrode losses to ensure that the 100 lm/w efficiency could be achieved. It is intended for use on those minor roads which also carry through traffic and therefore need to be lighted to a standard beyond the upper end of the present Group B recommendations.

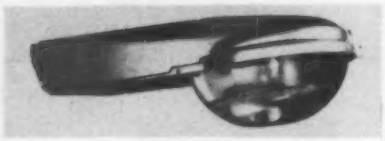
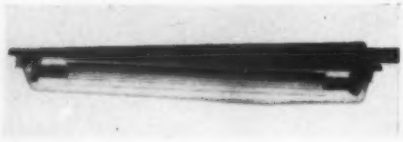
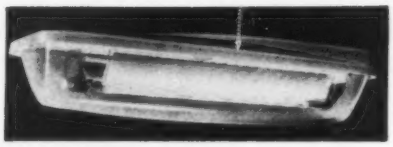
The Osram display also featured their improved 200w linear sodium lamp which is now in production. It differs from the original in having additional dishing of the discharge tube to maintain uniform distribution of sodium along the tube. The same firm also called attention to further increases in initial and life efficiences of fluorescent-bulb mercury lamps. These amounted to an additional 2 lm/w in life efficiency to the ratings from 250w to 1,000w and resulted from improved manufacturing techniques, notably the application of a nickel plating to the arc-tube support assembly to form a reflective surface.

Philips continued to lay stress on their U-tube 200w sodium lamp, which achieves an efficiency of 100 lm/w through life. As last year, they had a display demonstrating the differences in red content and efficiency of M/AV, MB/U and MBF/U mercury lamps, although last year's red buses had been replaced by a rotating barber's pole. Their range of colour-corrected lamps, as foreshadowed at the ASEE exhibition in March, has now been augmented by a 2,000w size, in both standard and reflector versions. There was also a special display of transistor-inverter fluorescent lamp circuits which are gaining widespread use in vehicles and for lighting road signs in districts where an electricity supply is not readily available. A practical example of this kind of equipment in service was to be seen in a fluorescent floodlighting unit demonstrated by Bergo.

Lantern displays

The re-appearance of this exhibition each year does not seem to tax the designers' ability to come up with something new and this year was no exception; most firms managed to show one or two new designs. What may prove to be of greatest significance was the Eleco 'Fluor-ray Slim 80' designed for use with two Philips 5 ft reflector fluorescent lamps; it consisted of virtually no more than a 'batten' fitted with canopy and enclosing clear 'Perspex' cover. With sectional dimensions of 5 $\frac{1}{16}$ in. depth and 9 $\frac{1}{16}$ in. width, it obviously goes far in meeting the demand for a slim, and simple fluorescent tube lantern. Another interesting development on the same stand was a lantern using the 700w, MBF/U colour-corrected mercury lamp. Known as the 'Silver Ray Major' (see page 381 of our Lantern Review) it is intended for use in higher mounting installations. In the same 'Silver Ray' family, there was the modifi-

The outdoor dispay of columns along the Spa approach road at Scarborough, seen, left, from the Spa itself and, right, from the other end.

Three new lanterns shown at the exhibition: left, the version of Eleco's 'Silver Ray' lantern in which control gear is incorporated in the hood; centre, the Revo 'Hyperion' lantern now adapted for the 30w tubular fluorescent lamps; left, GEC's non-cut-off lantern for their 200w linear sodium lamp.

cation to the original design for 250w or 400w mercury lamps with the control gear enclosed in the lantern hood; it has an identical performance to the 'Silver Ray' lantern whilst offering the advantage of containing its own control gear, complete with capacitor.

The GEC (in its Lighting and Heating Group) showed four new lanterns including the cut-off unit introduced earlier this year (page 381), which is also available with the control gear mounted within the canopy. For 'high power' installations, another mercury lantern, containing three lamps in line, was also shown together with a slender post-top design (page 383) for tubular flourescent lamps and having vertical refractor plates. There was also the lantern for 200w linear sodium lamps introduced last year which has now been joined by a cut-off version. New lanterns for Group B lighting included a design for 60w sodium lamps, in both cut-off and aero-screened versions, and a unit for two 2 ft, 40w fluorescent lamps (page 383).

Atlas had an interesting exhibit in the details of the lantern they are to provide for the Park Lane improvement scheme. This is a development of the 'Alpha Three' designed for three 400w, colour-corrected mercury lamps in line and having a reflector optical system. Another new mercury lantern was seen in the 'Alpha Seven' (page 381), the first refractor lantern Atlas have produced in the Alpha series for mercury colour-corrected lamps. Designed for 250 or 400w, MBF/U lamps, it has a glass refractor bowl producing the main beam at 78° from the downward vertical and a light-alloy body which combines end support and 'Opticell' in one unit. They also showed the 'Alpha Five' lantern for the 200w linear sodium lamp introduced in prototype form last year. It has a 'Perspex' refractor optical system giving a sharp run back from the peak. This same firm also introduced a miniature fluorescent bulkhead fitting in a weatherproof enclosure.

New lanterns for sodium lamps featured prominently on the AEI stand and included two designs in the 'Amber' series. One was a side-entry version of the 'Baby Amber' for Group B installations (page 379) using a 45 or 60w sodium lamp; the other was a side-entry enclosed lantern for Group A installations using the 140w sodium lamp. The complete 'Amberline' range of lanterns using the 200w linear sodium lamp was also featured and included the cut-off unit (page 379) introduced late last year. Another application for the same light source was seen in the M 30 floodlighting lantern, designed for supplementing normal street lighting at accident 'black spots' during periods of poor visibility. Lanterns for tubular fluorescent lamps featured a refractor version of the 'Kington' lantern for three 80w tubes and the 'Kuwait' and 'Carpenter' fluorescent lanterns having improved optical systems (page 382).

Phosco were featuring four new lanterns of which three were for sodium lamps. Of particular interest was the cut-off lantern (page 380) suitable for use with either the linear or U-tube version of the 200w lamp with optical control provided by two silvered ripple-glass reflectors. There was also a medium angle lantern for the 200w U-tube sodium lamps together with a similar unit for the 140w sodium lamp. Another new lantern was shown for 85 or 125w colour-corrected mercury lamps (page 382) with an enclosure of pin-spot 'Perspex'. In the post-top series, Phosco featured their new 'Promenade' unit for 100 or 200w tungsten lamps or 80w or 125w colour-corrected mercury lamps, this unit having been originally designed for installation at Frinton.

Interest was aroused on the A. C. Ford stand by two new lanterns, one a post-top design and the other a top-entry unit. The former, which is available in two versions, provides a universal unit for all types of lamps used in Group B lighting apart from tubular fluorescent. It has a silicon-aluminium canopy and enclosing envelope of opal 'Perspex'. The top-entry lantern, also designed for Group B lighting, is an improved version of the firm's A.C.356 design and is suitable for mercury or filament lamps.

An interesting modification of a lantern for the 200w linear sodium lamp was shown by Revo; it was their 'Hyperion' lantern introduced last year which has now been adapted for use with two 3 ft, 30w tubular fluorescent lamps whilst using the same refractor optical system with reflectors additionally available if required. A cut-off reflector has also been designed for the lantern when used with sodium lamps. Another modification was seen in the 'Bromley' post-top refractor lantern which,

Left, the new Dennis 5-ton vehicle fitted with Simon hydraulic platform and workshop built integrally with the cab. Right, the new Abacus Group B column with hinged base to permit access to the lantern from ground level.

originally designed for sodium lamps is now available in a version for 125w, colour-corrected mercury lamps. Conversely, the Helion post-top lantern for main road lighting, originally designed colour-corrected mercury lamps, has been modified to produce a version taking three 140w sodium lamps (page 383).

Away from street-lighting, the emphasis on fluorescent bulkhead lighting fittings, suitable for pedestrian subways and similar locations, was even more pronounced this year. Victor Products were showing a new weatherproof fitting for two 2 ft, 20w tubular fluorescent lamps suitable for either flush mounting or free suspension. The case is of cast aluminium alloy and carries a front frame of extruded aluminium alloy with opal 'Perspex' diffuser. Holophane had a bulkhead fitting for 50w colour-corrected mercury lamps, incorporating an elongated choke specially designed for integral mounting with capacitor.

Columns on show

Street lighting columns, arrayed along the approach road to the Spa, showed, in aggregate, that manufacturers are ever more conscious of the need to achieve aesthetic harmony between column and lantern. All in all, the display provided ample evidence that many present-day columns now combine attractive daytime appearance with functional efficiency.

New designs were to be found in plenty, particularly for the 30 and 35 ft mounting heights now being called for. In fact, Stewarts and Lloyds even had one of 40 ft —the column (shown with its accompanying lantern) they are to provide for the Park Lane improvement scheme. Made in tubular steel, its slender proportions were immediately noticeable; the diameter is only $8\frac{5}{8}$ in. at the base, reducing to $3\frac{1}{2}$ in. at the top. In the Stanton and Staveley display, newcomers were seen in the Type 12 series of concrete columns for 30 and 35 ft. There are two versions for each mounting height, with either straight or curved bracket arm. There were also the Concrete Utilities' 'New Highway' designs of concrete column for the same heights, introduced last year.

At the other end of the scale, the main emphasis seemed to be in simplifying installation and maintenance by using materials which combine low weight with an inherent resistance to corrosion. The aluminium columns familiar from previous years were augmented by designs from Alf'd Miles, a comparative newcomer to this field. There was one 25 ft column from this firm and three 15 ft columns. Another display of aluminium columns was shown by Metal Developments, including two Group A designs and indicating some of the variations in finish which can be achieved. A striking new design in this category was a column constructed wholly of resin-bonded glass fibre, shown by A. C. Ford. It comprised a single taper tube, 16 ft overall length and reducing from 9 in. diameter at the base to $2\frac{3}{4}$ in. diameter at the top. The GEC were also showing a glass fibre reinforced column for group B installations. New from Poles was the 'Zeta' column for Group B lighting; it is a one-piece circular column in galvanised steel, tapering from a 7 in. base to 3 in. diameter shaft. The same firm were also showing designs in the more familiar sectionalised form up to 35 ft mounting height, with aluminium offered as an alternative to galvanised steel where large quantities are involved. Abacus, who last year showed a hinged column to overcome the access problem at 25 ft mounting heights, have extended the same principle to 15 ft columns. They showed a 15 ft column hinged at the base, and, for access, it is lowered to about 20° above horizontal so that the lantern may be reached from the ground.

Ancillary equipment

The use of fluorescent lamps for lighting road signs and the like was seen to have become generally accepted. Apart from Bergo's transistor unit already mentioned, Gowshall were showing a sign lighting unit using a fluorescent lamp but designed for conventional operation from the mains. It had the facility for change-over to tungsten lamps should this be required, but its main feature was the simplicity of the method for gaining access for maintenance or relamping, involving no more than a twist of the thumb.

Time switches continued to excite certain interest although little new was noted in this particular section. Horstmann were devoting most attention on their display to their latest synchronous model, the Type V, Mark II, which has a 30 amp rating at mains voltage and is also provided with three day spring reserve. Emphasis on the Venner stand (away from the do-it-yourself parking system) was on the size reduction which has been achieved in consequence of today's slim columns without reducing the legibility of the dials. For complexity, Sangamo had a time switch providing two operating periods per day, to cater for half-night lighting during the winter months when the lighting is required to be switched on again in the early morning until sunrise.

An ingenious development shown by TMC was the multi-position fixing bracket which the firm now supply with power factor correction capacitors. Its main attraction is that it offers a wide variety of mounting positions to make the most efficient use of the limited space available in column gear compartments.

Below and right, further views of the outdoor section of the APLE exhibition, showing some of the tower wagons and other access vehicles displayed.

STREET LIGHTING TRENDS

Policy and Practice in Europe

The first part of this series of brief reports summarises street lighting practice in several European countries bringing out a number of interesting points in connection with light sources, codes of practice and luminance of the road surface. Part 2 deals with the controversial subject of lighting on motorways. The main problem is, of course, financial, but it will be noted that most of the contributors state or imply that fixed lighting will be necessary in time. Figures are quoted of traffic density above which it is considered lighting is essential to safety whilst M. Gaymard gives a figure above which lighting is also economic. There is clear agreement on the necessity to light access and exit roads and such installations deserve close study. In the UK opinions differ on the need to carry out large scale experiments on motorway lighting but it will be noted that an experimental installation will shortly go into service in Germany and that it is also proposed to carry out such tests in Switzerland; other countries are using their limited lighting at junctions to study the wider problem. It should also be noted that the first autoroute lighting in France (1953) became inadequate within a few years and even in a later and better installation provision has been made for improvements if required.

Part 1 Traffic Routes

Belgium

LEGISLATION currently in force in Belgium puts the lighting of roads under the communes. They generally carry out this duty satisfactorily in built-up areas but in the open country most roads are unlighted because they do not have the necessary financial resources. As a result a motorist travelling along a certain route meets with a succession of lighted sections separated by others which are unlighted. Further, as each commune acts independently, the traveller is faced with a wide range of light sources, lantern arrangements and even lighting-up times. For this reason it has been agreed, in principle, that the Ministry of Public Works should assume responsibility for the provision and maintenance of satisfactory lighting throughout the principal main roads of the country.

As far as existing installations, or those in course of erection, are concerned, present trends are as follows:

Sodium lamps are specified for the open country where the monochromatic colour is unobjectionable; the preference is for the 200w integral lamp which is now available.

Tubular fluorescent lamps were very popular a few years ago but there is a decided trend towards their replacement by colour-corrected mercury lamps. These are being used more and more in built-up areas and earlier installations using 80w and 125w lamps are being improved by using 250, 400 and even 1,000w lamps. Fluorescent tubes continue to be used in places such as shopping centres.

There are two trends in lantern design; the main one is towards the use of anodised polished aluminium mirrors, the other being towards the use of refractors. Enclosed fittings are being used more and more and in general, except for fittings housing tubular fluorescent lamps, they are of the cut-off type.

Columns are of metal or of reinforced concrete. In the open country the outreach is generally 3·5m because the columns have to be sited 3m from the edge of the road; in towns the outreach is less. Central suspension, which is very common, is tending to be replaced by mounting on one or both sides of the road. Mounting height shows a tendency to become standardised at 10m. Spacing tends to become shorter; whereas formerly a distance of 40–45m was accepted present-day spacings are generally 30m or even 25m—a result of the tendency to adopt higher levels of illumination and road luminance.

Without going as far as in France (where, for example, on the Autoroute du Sud the columns used are very attractive but also expensive) more and more importance is being attached to the aesthetic appearance of columns, brackets and fittings. Attempts are made, often successfully, to give the combination of these three components a more harmonious appearance.

The Belgian street lighting code is now out of date and the revision will probably be based on the Dutch code. There is a tendency to adopt values of luminance of the order of 1·5 cd/m² and a uniformity across the roadway of the order of 0·4.

A. BOEREBOOM

Whip-type aluminium columns at Forest in Belgium.

The Netherlands

Since the Nederlandse Stichting voor Verlichtingskunde (the Netherlands Illuminating Engineering Society) issued its 'Recommendations for Public Lighting' in

A local traffic route in the Netherlands; cut-off lanterns housing two 250w fluorescent mercury lamps, mounted at 30 ft and 83 ft spacing. Average road luminance 0·5 ft-L when new.

1959, considerably higher lighting levels (recommended average road luminance 0·6 ft-L) and better uniformity of luminance have been observed. In the past the use of cut-off distributions to reduce glare to a minimum often resulted in alternate bright and dark transverse streaks; the situation has, however, been improved by better optical designs of lanterns, by more careful checks on the cut-off, and by reducing the spacing-height ratio to values even lower than 3 : 1. Mounting heights of over 10m are now common for important installations.

A working group of representatives of the Ministry of Public Works, the National Laboratory for Road Construction, the Netherlands Illuminating Engineering Society and an industrial lighting laboratory is studying the problem of uniformity of road luminance, with the aim, *inter alia*, of improving reflection characteristics of road surfaces under dry and wet conditions.

Traffic guidance by means of the colour of the street lighting is widely used and the colour used on urban traffic routes is strikingly different from that used in streets serving local traffic only. This principle facilitates the traffic flow as drivers unfamiliar with a district find clear information on the route to be followed by the colour of the light. Traffic roads outside built-up areas, if lighted, are lit by sodium lamps exclusively; where trunk roads pass through built-up areas similar lighting is used. Mercury-fluorescent lamps are used only in traffic arteries giving access to town districts and in other streets of local importance.

As a rule roads outside built-up areas are not lighted. However, lighting is provided on all important intersections and such lighting is designed so that drivers do not suffer from glare when approaching from unlighted roads, nor from re-adaptation to the dark after passing the crossing. This lighting is always done with carefully cut-off sodium lamp lanterns.

Higher wattages and higher luminous efficiencies of light sources (200w sodium lamps, 700 and 1,000w mercury-fluorescent lamps) have been welcomed in view of the higher lighting levels to be achieved. These type of lamps, and those of lower wattage, are superseding tubular fluorescent and incandescent lamps.

Mention should be made of a successful trial installation on the square in front of the new municipal theatre at Tilburg which is lit by iodine-quartz incandescent lamps to an average of 140 lux. The lower efficiency of these lamps as compared with that of discharge lamps was accepted in view of the importance of an excellent colour rendering in this particular case.

J. B. DE BOER

Italy

There is no official street lighting code in Italy though recently ANIDEL (Associazione Nazionale Imprese Produttrici e Distributrici di Energia Elettrica) issued a publication which gives recommended illumination levels and uniformity ratios but no recommendations on the luminance on road surfaces. Public lighting engineers in Italy are tending to adopt the criteria of uniformity of luminance though the only guidance that is given to obtain the required uniformity are some general recommendations on the height, spacing and siting of lanterns. In the case of very important installations some experimental tests have been made.

As far as glare level and 'visual comfort' are concerned, Italian installations follow the 'continental practice' which is characterised by the use of cut-off systems, high mounting and fairly close spacing.

Light sources at present used are incandescent lamps (75 per cent of the total), tubular fluorescent lamps (12 per cent) and mercury-fluorescent lamps (13 per cent). Incandescent lamps are mainly used in large and medium size towns where they are limited to the improvement and extension of existing installations which are frequently fed by a system at constant current. In some cases aesthetic considerations prevail as in places of historical or architectural interest where discharge lamps would not be suitable. The use of fluorescent tubes developed considerably in recent years but there is now a noticeable reduction in further extensions. Nevertheless in some applications this light source seems to be competitive with the fluorescent bulb, as in those installations where a moderate illumination level (2–3 lux) is required and in main city streets bordered by buildings and with appreciable pedestrian traffic.

Lanterns are usually of the asymmetrical type. In most lanterns for bulb-type lamps light control is obtained by means of reflectors of pure aluminium (99·99 per cent) suitably treated and protected. The current preference of public lighting engineers is for open reflector-type lanterns. The trend is to incorporate all gear in the lantern. Much greater attention is being given to the appearance of lanterns.

In the past central suspension was common. In new installations, and particularly in those which use discharge lamps, on roads of up to 8m width the trend is towards siting on one side of the road only with a mounting height of 8–9m, with brackets giving a good overhang and a spacing of about 30m. On roads exceeding 10m in width staggered or opposite spacing is used.

The basic types of columns used are tubular steel or reinforced concrete; the first type is more common due to their lesser weight, ease of erection and slender appearance. The use of concrete poles is, however, justified by their relatively lower price and lower maintenance costs.

LINO RICHARD

Special lighting in Turin for the Italia '61 exhibition. Six lanterns (2 × 40w fluorescent tubes) on each column mounted at 30 ft and 100 ft spacing (same side). Incandescent lamps (25w) on base of brackets are ornamental.

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STREET LIGHTING TRENDS —

German installation of enclosed reflector-type lanterns housing two 125w fluorescent mercury lamps centrally suspended at height of 30 ft and spacing of 115 ft. Average illumination, 8 lux.

Germany

Street lighting installations in Germany are governed by DIN 5044 'Street Lighting Regulations' of May 1955, a supplement to which appeared in draft form in October 1959. The recommended mean illumination levels are graded according to traffic density and the reflection factor of the road surface. For main thoroughfares with approximately 1,000 vehicles per hour in each direction, for instance, 16 lux is recommended where the road surface is of dark coloured material. The ratio of the lowest to the mean illumination level should be not more than 1 : 3 and the ratio of the lowest to the maximum illumination level not more than 1 : 6. The standard is at present under revision. At some points of high traffic density, these recommended illuminations have already been substantially exceeded. In new installations the recommendations are generally adhered to, while in many older installations the present-day level has not yet been reached.

Because of their excellent luminous efficiency, tubular fluorescent lanterns are generally employed for mean illumination levels of up to about 12 lux. Span-wire suspension of the lanterns over the carriageway is now rarely employed and then mainly where the lanterns are arranged with their longitudinal axis parallel to the run of the street. In the majority of cases nowadays the lanterns are installed at right angles to the street on whip-type columns, with increasing importance being attached to the provision of adequate cut-off to prevent glare. The preferred ratio of mounting height to lantern spacing is between about 1 : 3·5 and 1 : 4. The standardisation of the height of such whip-type columns a few years ago to 6, 7·5, and 9·5m has proved satisfactory. For major roads the 9·5m columns are chiefly used and erected on one or both sides of the road, depending on the traffic density and the width of the road.

Since the number of fluorescent tubes required for achieving illumination levels adequate for high traffic density would be rather high (in Germany the lanterns on the market are constructed almost exclusively for operation with a maximum of three 65w lamps, and the development of lanterns to take 100 and 125w fluorescent lamps is in the very early stages) increasing use is being made of colour-corrected mercury lamps for main thoroughfares. The lanterns are sometimes suspended above the carriageway from span-wires, but more often they are mounted on the bracket arms of columns or on straight columns at the side of the road. These lanterns, in the main, use specular reflectors, and are usually of the dust-proof, totally-enclosed type in order to keep maintenance costs as low as possible.

A great deal of stress is laid on the combined appearance of lantern and column, particularly for the lighting of public squares and important road junctions. In a few isolated cases, xenon long-arc lamps of 10 and 20kw have been installed. The lighting of high-level roads, flyovers and bridges with fluorescent lamps built into parapets has been applied successfully in several places in spite of the greater expense incurred.

Sodium lamps have been employed in some places for distinguishing main through-roads and some lanterns in squares have also been fitted with a mixture of colour-corrected mercury and sodium lamps. Views on extending the use of sodium lamps are divided.

E. WITTIG

Switzerland

Generally speaking street-lighting in Switzerland is at present confined to towns and villages although some approaches to industrial areas and tourist-centres are also lit. The Swiss public lighting engineer's guide to the provision of continuous lighting on the highway is the publication 'Recommendations on Public Lighting: Part 1—Lighting of Streets and Squares' which was issued by the Swiss Lighting Committee in February 1961. This gives recommendations on the general requirements, light sources, lanterns, columns, planning and maintenance. Roads are classified as those with (a) light or medium traffic, (b) heavy traffic, and (c) arterial roads with exceptionally heavy traffic or those of special local importance. The table

A typical modern Swiss installation using 250w fluorescent mercury lamps in open reflector lanterns.

TABLE EXTRACTED FROM SWISS STREET-LIGHTING RECOMMENDATIONS

Maximum spacing of lanterns and minimum luminous flux per fitting for a mounting height of 10m and a road surface reflection factor of approximately 0·2.

Width of road (including cycle tracks)	Luminous flux			
	Distance between lanterns	Roads with light or medium traffic	Roads with heavy traffic	Arterial roads with exceptionally heavy traffic and roads of local importance
m	m	Av. illum. 5 lux	Av. illum. 10 lux	Av. illum. 20 lux
7	32	7,000	14,000	27,000
8	31	8,000	15,000	30,000
9	29·5	8,000	16,000	32,000
10	28	9,000	17,000	34,000
11	26·5	(9,000)	18,000	35,000
12	25	(9,000)	18,000	36,000
13	23·5	(10,000)	19,000	37,000
14	22	(10,000)	19,000	37,000
15	20	(9,000)	18,000	36,000
16	18	(9,000)	17,000	34,000
17	15·5	(8,000)	16,000	32,000
18	13	(8,000)	15,000	29,000

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opposite, which is extracted from the recommendations, enables the engineer to decide the desired light output and spacing for any road width or spacing assuming a mounting height of 10m and a road surface reflection of 0·2. New installations conform with these recommendations and in some cases exceed them.

As Switzerland is a country of several languages and very independent communities, many different solutions to street-lighting problems are to be found in various parts of the country. Light sources, however, are generally high pressure colour-corrected mercury lamps though in some parts tubular fluorescent lamps are used. In central Switzerland there are a number of new installations with mixed lighting, i.e. lanterns containing a colour-corrected mercury 125w lamp and a 60w sodium lamp.

Lanterns, particularly those using colour-corrected lamps, are normally of the reflector-type giving an asymmetrical distribution. Lanterns for fluorescent tubes, almost without exception, have 'Plexiglas' covers to ensure a more efficient light output in cold weather; the normally oval-shaped reflectors of the high pressure colour-corrected mercury lamps have no covers.

Columns are in most cases of zinc-plated steel giving a mounting height of 10m; spacing varies from 28–33m depending on the importance of the road. Lanterns are set at an angle of 15 deg. with an overhang of 2–3m. On roads 9m (or more) wide staggered spacing is used, but on roads exceeding 12m in width opposite spacing is usual. On roads with a central reservation twin-bracket columns are used, an arrangement which is considered to give drivers a good visual indication of the direction of the road.

F. BAHLER

Above, an approach to a roundabout on a Netherlands motorway; cut-off lanterns housing two 140w sodium lamps mounted at 33 ft. Average road luminance, 0·4 ft-L. Below, view of the Rotterdam-Hague motorway with columns superimposed; assumed spacing 115 ft, mounting height 40 ft, average road luminance 1 ft-L.

Part 2 Motorways

The Netherlands

The present official view in the Netherlands is that there is no need for lighting on motorways, which are defined as roads without cross-roads and with dual-carriageways divided by a central reservation designed to avoid glare from the headlights of oncoming cars. Some motorways, however, are crossed at large roundabouts (up to 600 ft. in diameter) and as these present an exception to the rule they are lighted.

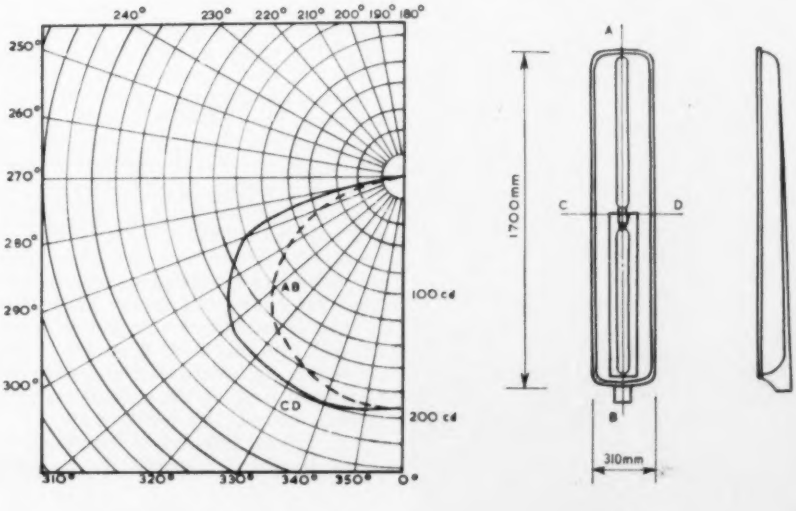
Experience shows, however, that, depending on local circumstances, e.g. the design of the motorway and of its access roads, exits, etc., some motorways must be lit if the density of traffic exceeds a certain figure. The first road where traffic conditions demanded a fixed lighting installation was the road connecting Rotterdam and the Hague. This road was reconstructed as a motorway and has now been in use as such, without lighting, for about two years. At peak hours it carries in one direction about 2,000 vehicles per hour. Recently it was decided to light this motorway. After a careful study, partly on a full-scale model of the road in an open-air laboratory for street lighting, the system illustrated was chosen. This installation will probably be completed before the end of this year. When in use it is understood that motorcars will drive on side lights only.

In the meantime two other roads (Amsterdam–Haarlem and Hengelo–Enschede), also in the course of reconstruction as motorways, are already showing such high traffic densities that the Ministry of Public Works has decided to light these roads as well.

Summarising, it might be stated that although, in general, motorways are not lighted, in some cases of very dense traffic (about 2,000 vehicles per hour in one direction) a fixed lighting installation of such quality that the use of headlights on motorcars can be avoided, is considered to be essential in the interests of safety.

J. B. DE BOER

Light distribution (reduced to 1,000 lm) and main dimensions of lantern designed for the Rotterdam-Hague motorway, two 200w sodium lamps per lantern.



Belgium

stressed reinforced concrete, or of tubular

STREET LIGHTING TRENDS — POLICY AND PRACTICE IN EUROPE

Italy

An extensive programme for the construction of motorways is being developed in Italy and the opportunity thereby given to provide permanent lighting is being carefully examined. At present it is generally accepted that the lighting of motorways with permanent installations along their whole length is impracticable due to the high annual costs and to the relatively low density of night traffic. This applies both to motorways with dual carriageways and those with single carriageways and it is unlikely that, in spite of the natural increase in traffic, any different conclusion will be reached in the near future. The main reason for this conclusion seems to be the high running costs, in which connection it has to be noted that the energy supplied for lighting toll roads is not exempt from the very heavy taxes applied in Italy on energy for lighting purposes.

On the other hand it is considered necessary to provide permanent lighting at lay-bys, intersections, junctions and service areas and this is in fact being done. The result is that the tendency is to light motorways only on a length of about 300m before and after lay-bys; approaches to junctions and service areas are provided with lighting on all their length. The light source employed in existing installations is the 250w fluorescent mercury lamp. Where such roads are straight it is usual to employ twin-arm columns sited on the central reservation. The mounting height of the lamps is about 10m and the spacing varies from 40 to 45m. Cut-off, and sometimes also semi cut-off and non cut-off, lanterns with refractors have been used.

Of a certain interest are some data concerning the 'Autostrada del Sole' which will be about 750km long, 300km of which are already open to traffic. On the basis of the installations already completed, it is possible to calculate that the total of the lighted stretches will be about 115km, made up as follows:

Carriageway at lay-bys	40km
Junctions and intersections	65km
Service areas	10km

The lighted stretches of the carriageway therefore amount to just over 5 per cent of the whole motorway or 15 per cent if we also consider lighted junctions, intersections and service areas. On completion the number of lamps will be 4,500 with a total load of 1,100kw.

This motorway also includes some examples of tunnel lighting. The section between Bologna and Firenze includes 31 tunnels, with a total length of about 6km, all of which are provided with permanent lighting installations using 40w tubular fluorescent lamps giving an average illumination of 20 lux. Additional lighting to provide 1,000 lux for 120m at entrances and exits is obtained by using 400w fluorescent mercury lamps.

LINO RICHARD

The Autostrada del Sole, Italy: lighting at a lay-by with 250w fluorescent mercury lamps mounted at 33 ft and 130 ft spacing.

A high level motor road at Stuttgart lit by recessed fluorescent tubes in the parapets on both sides of the road.

Germany

So far none of the German State autobahns has been equipped with permanent lighting. Although lighting engineers have argued in favour of lighting, the authorities have always been of the opinion that the costs would be too high. In recent years various lighting installations have been provided only for autobahn access and exit roads in the vicinity of large cities and for a few highways of similar character. On most of the roads conventional street-lighting systems have been employed. An unusual installation is that on the so-called Heerdter Dreieck or Triangle near Dusseldorf which comprises a number of roads similar to the autobahn. The lighting installation in this case does not direct its luminous flux particularly on to the carriageways but also lights up the adjacent areas between the various carriageways and flyovers from a small number of 40m columns on each of which are mounted six lanterns each with two 400w mercury lamps and one sodium lamp (see *Light and Lighting*, April 1961, p. 100). In another case, in Stuttgart, the incident light has been restricted to the carriageway by installing lanterns with 65w fluorescent lamps in the parapets on both sides of the road (see illustration).

The Federal Ministry of Transport recently decided to investigate the technical possibilities of providing lighting for the autobahn, or at least for those parts where there is a very high traffic density, and to gather experience on the problem. For this purpose it is intended to install an experimental installation on a 7·5 km stretch of the autobahn between Cologne and Leverkusen by the end of this year. This section has a central reserve 5m wide flanked on both sides by a three-lane carriageway 11·5m wide and a 3·25m emergency-stop strip. Two different lighting systems are being tried out. The first system will consist of lanterns each with two 65w reflector fluorescent tubes suspended very 10m at a height of 12m over the central reservation from a wire similar to a trolley wire and arranged parallel to the longitudinal axis of the road. The distance between the supporting columns will be 60m. The luminous flux will be directed mainly onto the two carriageways by means of built-in specular reflectors. The second system will have twin-bracket columns every 46m along the central reservation. The bracket arms are to be 4m long and will carry, at a height of 12m, totally enclosed oval specular-reflector lanterns each containing one 400w colour-corrected mercury lamp inclined upwards at an angle of 10°. In both systems the required illumination of 14 lux and a ratio of minimum and maximum illumination of 1 : 6 are ensured.

Colour-corrected mercury lamp lanterns are also to be used for lighting a number of autobahn access roads.

E. WITTIG

Belgium

The administration of the Belgian motorways and for any lighting installed on them is the responsibility of the State.

There are at present about 220km of motorways in Belgium, the most important being:

Brussels–Ostend (120km)
Brussels–Antwerp (45km)
Brussels–National Aeroport (10km)
Brussels–Liege–Aix la Chapelle (40km completed, the remainder under construction).

In addition there are 10,000km of State roads, 1,000km of roads administered by the provinces, and 60,000km of roads administered by the communes. Except where these roads pass through built-up areas they are lighted badly or not at all. To ensure good and uniform lighting it has been decided that the State shall carry out and pay for lighting throughout the principal important roads in the country. The programme envisages the lighting of something like 1,000km of roads in the next few years and the expenditure of 250 million francs (£1·8 million) during the next five years has been approved.

Priority having been given to providing a high standard of continuous lighting on the main roads, financial resources are insufficient, at present, to light the motorways as well. It is, however, considered that lighting is necessary because of the continuous increase in traffic.

At the same time, the Ministry of Public Works has just begun to install lighting on the access roads to the Brussels–Ostend motorway. This lighting also covers those parts of the roads near the access points and that part of the motorway which lies between these points. 200w integral sodium lamps are being used because of their high efficiency; fittings are of the cut-off type.

The light distribution is as follows:

	Values specified	*Values obtained*
Av. luminance B_m	1·1 cd/m²	1·55 cd/m²
Uniformity of luminance across the road	0·40	0·44
B_{min}/B_m	0·60	0·602
$I_{80°}$	30 cd	27 cd
$I_{90°}$	20 cd	10 cd

The level of 1·50 cd/m² for the average luminance B_m is that now prescribed for the lighting of main roads in Belgium. The values laid down for the uniformity across the road and for B_{min}/B_m are visually satisfactory. At the same time the values of luminous intensity $I_{80°}$ and $I_{90°}$ at angles of 80° and 90° from the vertical, referred to a lamp output of 1,000 lm, result in a cut-off fitting giving no objectionable glare.

The light sources are mounted at a height of 10m above ground with a spacing of about 25m on a bend and 27m on a straight road. The columns used are of prestressed reinforced concrete, or of tubular steel, with an overhang of 4m. The columns are of the whip type which is now usual for installations of this kind.

The work is in progress at the present time and will be completed at the beginning of 1962. This installation will provide an opportunity for studying the technical requirements to be laid down for the lighting of motorways proper which will follow in due course.

A. BOEREBOOM

France

There is a considerable body of opinion in favour of the lighting of motorways on grounds of safety. Table 1 shows the large number and the serious nature of the personal accidents which occurred on French roads *outside daylight hours* in 1959.

Considering that the night-time traffic is 16 per cent of the total in summer, 35 to 40 per cent in winter, and through the whole year 22 to 25 per cent of the total, it is easy to see that the personal accident rate at night is at least 50 per cent greater than that by day. Thus if the lighting of a motorway is good enough to reduce the night rate to that of the day, the average night risk will be reduced by about 35 per cent.

It is interesting to find that this conclusion is confirmed by experience obtained on the Autoroute de l'Ouest which was lighted in two stages, the first in December 1953, the second in October 1954. During the twelve months following the installation of the lighting on the first section there was a reduction of 27 per cent in night accidents of all kinds on this section whereas there was an increase of 20 per cent on the unlighted section. The lighting of this first section therefore reduced the night accident risk by about 40 per cent.

Financial justification

The lighting of motorways can be justified on purely financial grounds, as may be shown by a calculation based on data supplied by the Road Authority (la Direction des Routes) and by the Professional Group of the Accident Assurance Companies:

(1) Average value of a human life £9,000
(2) Average assessment of a serious injury £350
(3) Average value of material damage in an accident £170

The Autoroute du Sud showing high and even luminance of the two carriageways.

(4) Average rate of personal accidents on a motorway
144 per 100 million vehicle-miles

If V is the average number of *thousands* of vehicles using the road each night, the number of accidents prevented per mile and per year is about $0·16V$. This means a financial saving of £$160V$ for the current year, and a factor of 1·6 should be applied for the period of amortisation of the capital invested.

The cost of the complete lighting installation on 1 mile of a motorway (two carriageways 35 ft wide with a central reservation) may be taken as £18,500. Amortisation at the rate of 8 per cent of capital comes to £1,480 per annum. Maintenance and running costs are of the order of £1,160 per mile per annum.

It follows that, under these conditions, the installation pays for itself when the traffic reaches an average of 10,000 vehicles per hour during the hours of darkness and twilight, a figure less than two-thirds of the average night traffic on the Autoroute de l'Ouest.

Motorways actually lighted

The principal sections of motorways in France that are lighted are:

(1) The main section of the Autoroute de l'Ouest, a little over 6 miles long;

(2) The main section of the Autoroute du Sud, a little over 9 miles long, if the Orleans and Orly branch roads are included;

(3) The Lille by-pass.

The Autoroute de l'Ouest from Paris, the main part of which consists of two

Table 1

	Personal accidents	*Number killed*	*Number injured*	*Fatal accidents*
Daytime	45,090	3,345	63,543	3,089
	(100)	(7·42)	(140·9)	(6·85)
At dusk and at night	21,681	2,586	31,120	2,367
	(100)	(11·92)	(143·5)	(10·91)

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carriageways with three 10-ft lanes each (total 30 ft), separated by a central reservation 5 ft wide, is lighted from 42-ft columns at a spacing of 165 ft. These columns carry two arms apiece, each with a fitting containing a 250w mercury fluorescent lamp (9,500 lm initially). The total width lighted is about 69 ft, so that the initial flux is $(2 \times 9{,}500)/(165 \times 69)$, i.e. about 1·7 lamp lumens per sq ft. Today this value of illumination has become insufficient for a thoroughfare carrying heavy fast traffic. (The installation described does, in fact, go back to 1953.)

The Autoroute du Sud, leaving Paris just south of the Parc de Montsouris, is connected with the Paris outer ring road by four one-way curved tunnels. At the southern end of these tunnels is the start of the main section of the road, just over 6 miles long, passing at first through an urban and further on through a rural area. This main road, which is wider than the Autoroute de l'Ouest, has two one-way carriageways, each of three lanes 11 ft 6 in wide (total 34 ft 6 in), separated by a central reservation of 15 ft. Along the centre of this reservation runs a mound 5 ft wide at the base and 18 in wide at the top. This mound has breaks at intervals of 50 to 65 ft to accommodate clumps of bushes which prevent drivers from being dazzled by the driving lights or passing lights of vehicles approaching from the opposite direction, a state of affairs common on the Autoroute de l'Ouest.

Mounted at intervals of 100 to 120 ft over the centre-line of this mound are twin columns, about 40 ft high to the lamps, with an outreach of 10 ft over the carriageway. Each column in the pair carries a fitting with a 400w mercury fluorescent lamp (21,000 lumens initially). The total width to be lighted being about 80 ft and the distance between columns in the neighbourhood of 105 ft, the initial flux is $(2 \times 21{,}000)/(105 \times 80)$, i.e. about 5 lamp lumens per sq ft.

At the end of the main road, one of the branches goes on to Longjumeau to serve Orleans, the other goes to le Plessis-Chenêt and is continued by Highway 7 (towards Fontainebleau and the south-east). Owing to lack of funds, the original lighting installation is confined to the main section of road and the Longjumeau and Orly branches.

The power supply to this installation is of interest. The energy supplied by Electricité de France is transformed down to medium tension (5,000v); the 5,000v cable is buried in the central mound and feeds small underground transformers located at intervals of about 650 ft and giving 220/380v to the lamps. An interesting feature of this installation is that provision has been made throughout to enable the value of illumination to be increased easily and cheaply; the size of the cables and all conductors, the dimensions of the lanterns and the space available in the columns for auxiliaries all provide for a future increase in the wattage of the lamps.

Table 2 gives details of the lighting of the two autoroutes and includes, for comparison, details of the proposed lighting on the Rotterdam-Hague motorway in the Netherlands which has exactly the same dimensions as the Autoroute du Sud, i.e. two carriageways 34 ft 6 in in width separated by a 15-ft central reservation.

Conclusions

The conclusions that may be drawn from the facts stated above are:

(1) When the night traffic exceeds 10,000 vehicles per hour, the lighting of a motorway is not only desirable for safety reasons, but can be justified on financial grounds.

(2) The obstacle which prevents all thoroughfares carrying this volume of traffic from being efficiently lighted is financial. (An under-estimate is often made of the cost of installing good lighting on a motorway, viz. £14,000 to £21,000 per mile.)

(3) Since the financial resources of the Road Funds are not even sufficient for the construction of the whole network of motorways needed, it would not be reasonable to deplete them by the amount required for lighting.

(4) It must be remembered that, besides the considerable initial cost of lighting a motorway, there are maintenance and running costs which amount, on the average, to at least 10 per cent of the initial costs. This hampers still further the development of motorway lighting.

(5) For all these reasons, it is certain that the motorways now in course of construction will not be lighted throughout but only at certain special places (entries and exits, forks and tunnels).

On the other hand, it is certain that the illumination levels adopted in the future will be similar to that provided on the Autoroute du Sud.

L. GAYMARD

Table 2

	Motorway Rotterdam-Hague	*Main section of l'A. du Sud*	*Main section of l'A. de l'Ouest*
Mounting height	41 ft	39 ft	42 ft
Spacing	115 ft	105 ft on dark road surface 120 ft on light road surface	165 ft
Light sources	2 × 2 sodium lamps 200w (20,000 lm)	2 fluorescent lamps, 400w (19,000 lm)	2 fluorescent lamps, 250w (9,500 lm)
Flux	80,000 lm	38,000 lm	19,000 lm
Lamp flux per sq ft	8·2 lm	5·1 lm on dark road surface 4·7 lm on light road surface	1·7 lm

Switzerland

The construction of the intended 1,800km of motorways in Switzerland is still in its early stages, and so are the intended express-highways, some of which are still being planned. About five years ago specialists and local authorities began discussing whether these fast traffic roads should be lit and whether the cost would be justified. The Swiss Lighting Committee and the Swiss Motoring Clubs pointed out to the road-planning authorities that a continuously lit highway is essential to road safety. At the same time it was found that the cost of installing lighting during the construction of the road would increase the overhead cost by about 3 per cent.

At present a group of experts from the Swiss Lighting Committee are compiling a set of recommendations for the lighting of motorways and express-highways and they are already discussing the preliminary draft. These recommendations suggest that motorways and express-highways should be continuously lit and the desired illumination level should be between 15 and 30 lux. It is thought that lighting of the highway should permit motorists to drive at approximately 100km per hour using sidelights only. Large scale tests will eventually show the exact lighting level needed to attain these requirements.

On roads which for financial reasons cannot be lit it is thought that at least the more dangerous sections of the road, e.g. road junctions, bridges and tunnels, should be lit, and if these stretches are not far apart then the section linking them should also be continuously lit; motorways which are constructed in the first place without lighting should have built-in channels for the later installation of electric cables.

At present the sodium lamp is considered most suitable for lighting motorways because it is more economical and the light gives better contrast. On express-highways

high-pressure colour-corrected mercury lamps will probably be used. Recent developments in the British and American laboratories indicate that improvements in efficiency and life can be expected in these lamps so that the whole question of the choice of light-source will have to be reconsidered.

The new Swiss motorways will have two carriageways, each 7m wide and a central strip 4m wide. On the outside of each carriageway there will be a strip 2·5m wide reserved for stationary cars.

Including the kerbs the overall width of a motorway will be 26m. The use of twin-bracket columns on the centre strip would seem to be the most suitable way to light the traffic lanes. The height of the light source would be 10 to 12m above the road surface. It is proposed to use light fittings with a symmetrical light distribution. From the aesthetic and economic point of view columns on the central strip are advantageous but the fear has been expressed that drivers would prefer to use the better lit inner lane and thus the entire surface of the roadway would not be used.

In summing up, it can be said that the lighting of motorways and express-highways is still in the planning and experimental stage. In contrast to the lighting of other roads the lighting of motorways and express-highways is being planned by a small group of experts so that efficient and widely uniform solutions will be achieved.

F. BAHLER

Motorways in the USA

The following notes are based on information supplied and though they do not deal with policy and practice in the same way as the contributions on European practice they are included to give some idea of motorway lighting in the USA.

One can travel for hundreds of miles on the network of expressways, super-highways, throughways and turnpikes in the USA with never a check or halt, except for the payment of tolls. From near the big cities one can whisk into the centre with very little trouble as at Cleveland where even during the morning rush hour one can go from one end to the other with scarcely a check, thanks first to a stretch of timed signals and then to an elevated highway. One gets into the middle of Chicago along a highway with four lanes in each direction, all crowded with cars travelling at about 60 mph. Detroit is traversed by two major expressways which meet at a very complex intersection in the middle. A series of expressways leads the Long Islander into New York, and Manhattan has an expressway up both the east and the west sides. At peak periods these highways carry very heavy fast traffic, and it is fairly clear that a minor misadventure is likely to cause multiple rear-end collisions and a severe traffic jam.

In the neighbourhood of the cities these expressways, which are all to motorway standard, are lighted quite well. The method varies; some use tungsten lamps with the old reflector-deflector lantern; some have the newer type of the same lantern with 400w mercury fluorescent lamps, mounted at about 30 ft on the outer kerbs, and in dry weather lighting fairly well to the centre reservation. In others, fluorescent lanterns are carried on single columns set on the centre reservation at approximately 35 ft high; some of these lanterns are rather heavy though more recent examples are a fine slim design which harmonises well with the slender steel column and bifurcated double bracket, reminiscent of some Continental designs. In Detroit the central part of the main intersection is lighted by fluorescent lanterns on both sides of the carriageway and in the slip roads.

In open country the turnpikes are not usually lighted; but an exception is the Pennsylvania Turnpike. This turnpike runs through a heavily settled area, with very good residential properties, and it carries much heavy goods traffic to the New England industrial area. It is lighted by uncorrected mercury lamps on the outside of the carriageways, with the columns beyond the hard shoulder and the lanterns over its edge. Spacing is 100 ft staggered and the mounting height 30 ft. A section nearer to New York has tubular fluorescent lanterns similarly mounted. The carriageway surface is concrete, quite well smoothed and rather oily. The light distribution was non-cutoff, but markedly non-axial and there is no troublesome glare.

The lighting of the mercury section in dry weather is quite adequate; it may not be as good as the French Autoroute du Sud, but it is sufficient to give drivers adequate information both as to the contour of the road and the nature of vehicles ahead. The vehicle lights themselves mean much more than on an unlighted highway where their interpretation is difficult. Movements of vehicles can be seen without difficulty and interpreted in plenty of time to take safe action. Drivers of vehicles have in fact expressed their relief on entering the lighted section where they feel that they can drive without strain as in daylight and could drive, were it permitted, with parking lights only. Some of the turnouts have been differentiated by the use of the 'yellow mercury' lamp—a high pressure mercury lamp with a yellow outer bulb, for the Americans have no sodium lamps—and drivers found the differentiation excellent.

The lighting of this turnpike is a clear contribution to safety and to traffic movement and the general impression seems to be that the sooner there is more of it the better pleased will all drivers be.

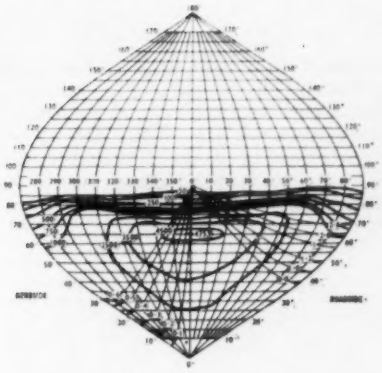
The six-lane Bronx-Whitestone bridge over the East River, New York, lit by 400w colour-corrected mercury lamps mounted on 24 ft columns at 100 ft spacing.

STREET LIGHTING TRENDS

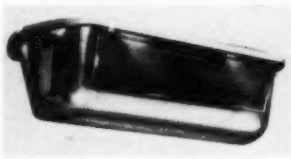
New Street Lighting Lanterns

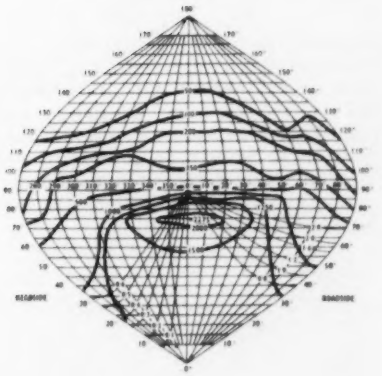
Lanterns for sodium lamps

AEI 'Amberline' cut-off lantern for Group A lighting: an enclosed unit for one 200w, SO/HL lamp. It comprises an end piece cast in LM6 aluminium alloy which supports an enclosure comprising a black 'Perspex' canopy cemented to a flat clear 'Perspex' visor panel. The casting carries the lamp support channel assembly comprising terminal block, cable clamp, earth screw and thermal relay; an aperture in the base of the casting (normally closed by a cover plate) provides access for relamping. Optical control is privided by specular magnesium-aluminium alloy reflectors fitted within the canopy.

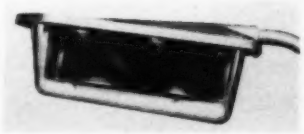


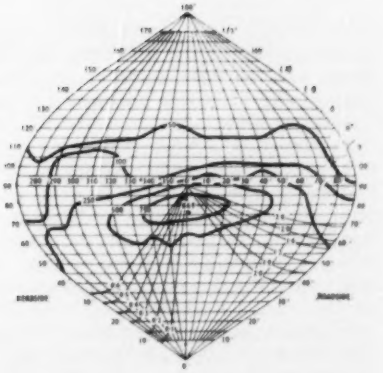
AEI 'Amber' non-cut-off lantern for Group A lighting: an enclosed unit for one SOI/H lamp of either 85w or 140w. Its canopy is a single-piece silicon-aluminium casting, painted internally white and externally aluminium, to which an enclosing bowl of slightly diffusing 'Perspex' is hinged at the roadway end, being secured at the bracket end by a retaining clip. Terminal block and earth terminal are provided adjacent to the bracket entry and a porcelain b.c. lampholder at the roadway end. Optical control is effected by 'Perspex' refractor plates sealed to the internal surfaces of the bowl, giving a medium angle distribution.



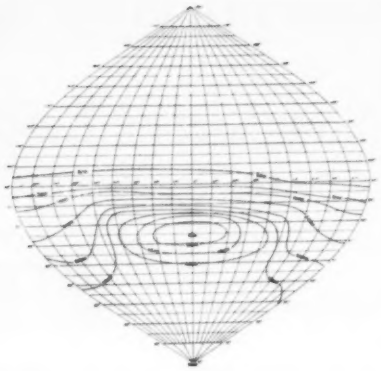


AEI 'Amber' non-cut-off lantern for Group B lighting: an enclosed unit for one SOI/H lamp of either 45w or 60w. Of the same 'family' as the 140w lantern of the same name, this has a canopy cast in silicon-aluminium, painted white internally and aluminium externally. An enclosing bowl of diffusing 'Perspex' is hinged to it at the roadway end and secured by a clip. Optical control is provided by 'Perspex' refractor plates sealed to the internal surfaces of the bowl, giving the equivalent of a medium angle distribution.

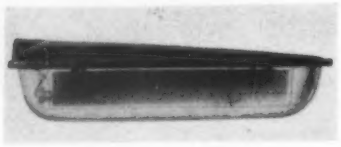


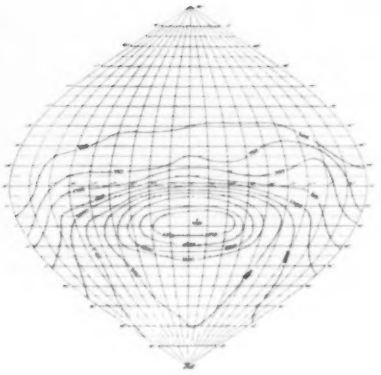


PHOSCO P.131 cut-off lantern for Group A lighting: an enclosed unit for one 200W lamp of either SO/H or SO/HL type. The canopy is of cast aluminium with a hammered paint finish in metallic beige. It is enclosed by a dish-shaped panel of clear 'Perspex', hinged along one side and secured on the other side by clips. Optical control is by two silvered, ripple-glass reflectors.

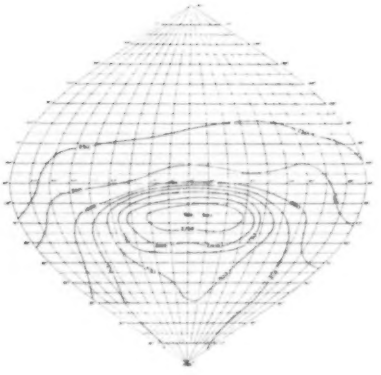


PHOSCO P.161 non-cut-off lantern for Group A lighting: an enclosed unit for one 200W, SO/H lamp. The body is of cast aluminium, with hammered paint finish, and an enclosing bowl of 'Perspex'. Optical control is by 'Perspex' refractor plates sealed to the internal surfaces of the bowl.



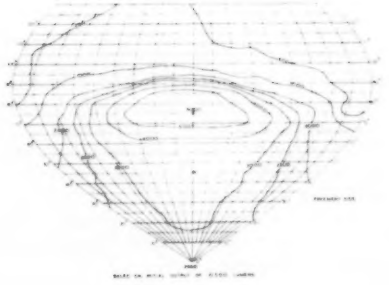


PHOSCO P.156/157 non-cut-off lantern for Group A lighting: an enclosed unit for one SOI/H lamp of 85W or 140W. Available for either top or side entry, the canopy is of cast aluminium with a hammered paint finish. It is enclosed by a bowl of clear 'Perspex'. Optical control is by 'Perspex' refractor plates sealed to the internal surfaces of the bowl.



ELECO HW1022 'Golden Ray 200' non-cut-off lantern for Group A lighting: an enclosed unit for one 200W, SO/H lamp. Canopy and bowl ring in die-cast LM6 aluminium alloy, finished internally in white stoved enamel paint and carrying a porcelain b.c. lampholder, porcelain terminal blocks, earth screw, cable clamp and lamp support bracket. It is enclosed by a side-hinged one-piece bowl of slightly diffusing 'Perspex'. Optical control is effected by 'Perspex' refractor plates sealed to the internal surfaces of the bowl and giving a medium-angle distribution. The type HW1120 lantern, optically identical, incorporates the control gear within the hood.

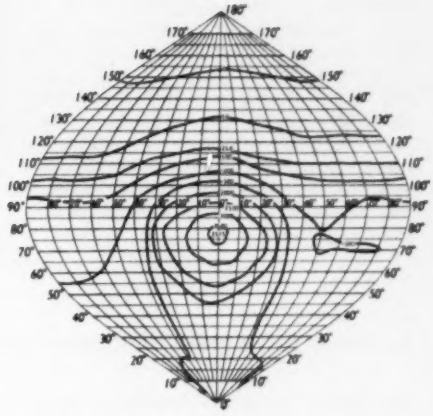
Optical efficiency: 86 per cent



Lanterns for bulb-type mercury lamps

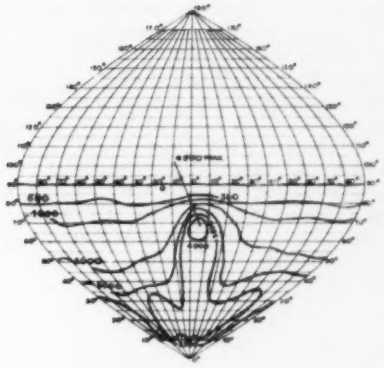
ATLAS 'Alpha Seven' non-cut-off lantern for Group A lighting: an enclosed unit for one MBF/U lamp of 250 or 400w. The body is a single casting of silicon-aluminium alloy finished internally in white stoved enamel and externally in grey aluminium. It is enclosed by a moulded glass refractor bowl providing optical control, and which is held in a cast alloy bowl ring hinged at the bracket end and secured by two captive screws. The optical system produces an axial distribution with the main beam at 78° from the downward vertical.

For 400w, MBF/U lamp
Optical efficiency: 65 per cent
Directional intensity ratio: 2·4
Output below horizontal: 9,550 lm

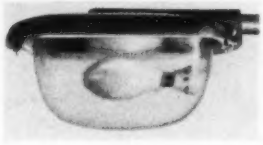


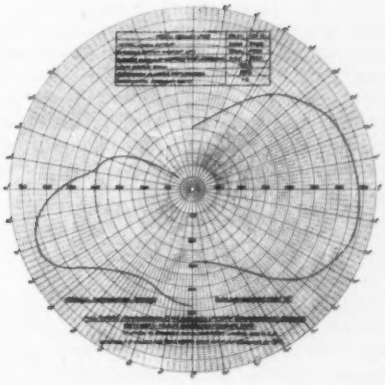
GEC 'Z8420' cut-off lantern for Group A lighting: an open unit for one MBF/U lamp of 250 or 400w. The body is of die-cast aluminium carrying a hood of pressed aluminium, with a white stoved-enamel finish internally, hinged at the roadway end, swinging outwards to give lamp access. Each side of the hood forms a long curved reflector to give the required cross-over distribution, with further control effected by special facings imported to top and ends of the hood. An optically identical version, 'Z8420G' incorporates control gear within the body.

For 400w, MBF/U lamp
Optical efficiency: 70 per cent
Directional intensity ratio: 2·31

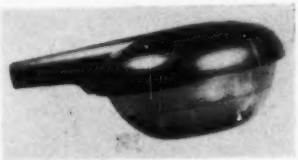


PHOSCO P.149 non-cut-off lantern for Group B lighting: an enclosed unit for one MBF/U lamp of 80 or 125w. It comprises a canopy of cast aluminium, finished externally in hammered paint of metallic beige and enclosed by a bowl of moulded, 'pin-spot' acrylic. Optical control is effected by a specular reflector of polished anodised aluminium. The lantern may be operated at inclinations to the horizontal of up to 25°.

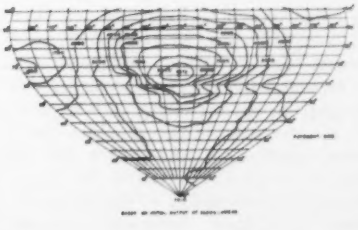




ELECO HW956 'Silver Ray Major' non-cut-off lantern for Group A lighting: an enclosed unit for one 700w, MBF/U lamp. Canopy and bowl ring die-cast in LM6 aluminium alloy enclosed by moulded glass refractor bowl hinged on one side and secured on the other by quick-action toggle catches. Optical control provided by the refractor bowl in combination with internal specular reflectors giving medium angle distribution.

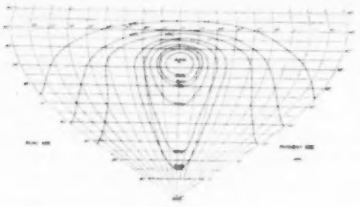


Optical efficiency: 61 per cent
Output in lower hemisphere: 30,600 lm (initial)



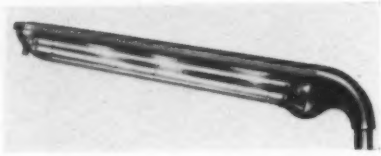
ELECO HW918 'Silver Ray Junior' non-cut-off lantern for Group B lighting: an enclosed unit for one MBF/U lamp of 80 or 125W burning horizontally. Canopy and bowl ring are die-cast in LM6 aluminium alloy enclosed by a side-hinged semi-elipsoidal bowl of clear stipple-finish 'Perspex'. The optical system comprises two main side reflectors and two auxiliary reflectors below the lamp, giving a narrow, axial, medium-angle beam. The lantern may be operated inclined to the horizontal at up to 25°.

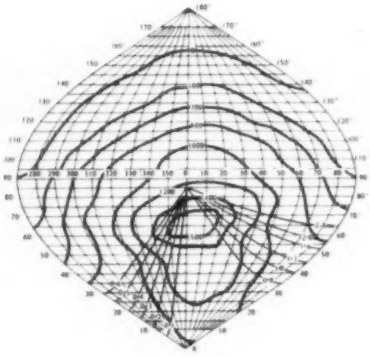
For 125W, MBF/U lamp
Optical efficiency: 82 per cent
Output in lower hemisphere: 4,250 lm (initial)



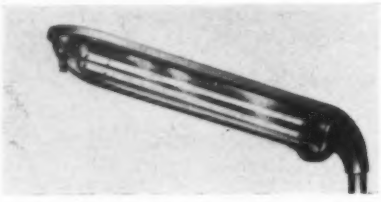
Lanterns for tubular fluorescent lamps

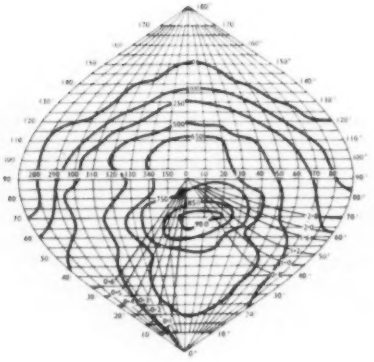
AEI 'Kuwait' non-cut-off lantern for Group A lighting: an enclosed unit for three 80W, MCF/U lamps. The body consists of a pressed aluminium canopy concealing a central cantilever bracket bolted to an aluminium head casting which supports the lantern on the column top at an angle of 10° above horizontal. It is enclosed by a moulded clear 'Perspex' bowl hinged at the column end and secured at the roadway end by a single captive screw. Optical control is provided by specular aluminium reflectors mounted on the cantilever bracket giving medium-angle distribution.



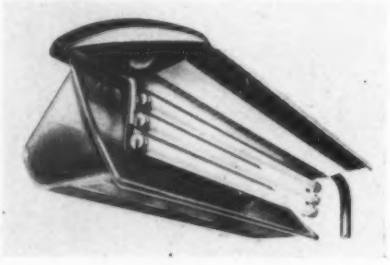


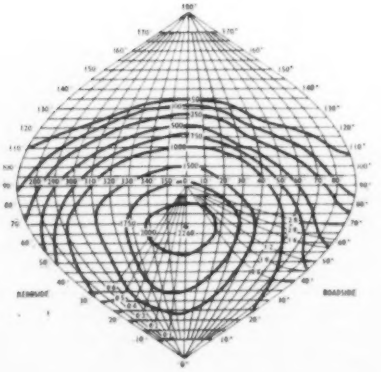
AEI 'Carpenter' non-cut-off lantern for Group A lighting: an enclosed unit for four 30W, MCF/U lamps. The body consists of a pressed aluminium canopy concealing a cantilever bracket secure to an aluminium head casting which supports the lantern on the column top at an angle of 10° above horizontal. It is enclosed by a moulded bowl of clear 'Perspex' hinged at the column end and secured at the roadway end by a captive screw. Optical control is provided by specular aluminium reflectors giving a medium-angle distribution.



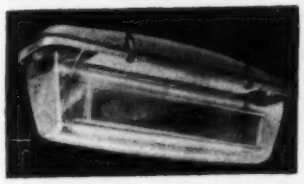


AEI S1/77207 'Kington' non-cut-off lantern for Group A lighting: an enclosed unit for three 80W, MCF/U lamps. The body comprises a canopy of magnesium-aluminium alloy sheet cemented and screwed to end castings of silicon-aluminium. It is enclosed by a 'Perspex' bowl hinged on one side on 'Diakon' blocks and secured by quick-release catches. Instant start control gear is mounted on a tray concealed above a hinged, sheet steel cover, to each end of which are secured two brackets carrying three lamp clips one above the other. Optical control is effected by 'Perspex' refractor plates sealed to the internal surfaces of the bowl. The lantern is designed for mounting at 10° above horizontal.

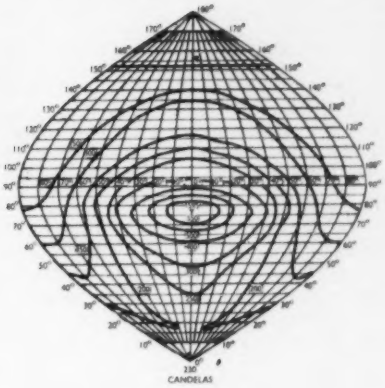




GEC 'Z8254' non-cut-off lantern for Group B lighting: an enclosed unit for two, 2 ft, 40W, MCF/U lamps. It comprises a die-cast aluminium alloy body enclosed by a side-hinged bowl of 'Perspex'. Optical control is effected by 'Perspex' refractor plates sealed to the inside surfaces of the bowl.

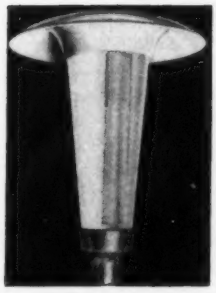


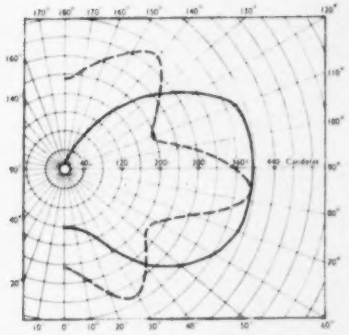
Optical efficiency: 75 per cent
Directional intensity ratio: 2·4



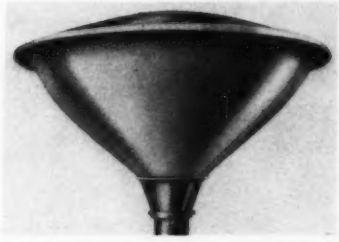
Post-top lanterns

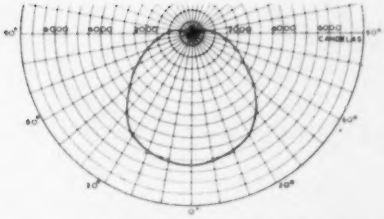
GEC 'Z.8449' lantern for Group B lighting, employing two 2 ft, 40W, MCF/U lamps burning vertically. The body comprises upper and lower aluminium spinning, separated by a cylinder of 'Perspex' tapering towards the base. Optical control is provided by two vertical 'Perspex' refractor plates placed diametrically opposite and sealed to the internal surface of cylinder.





REVO C.16198 'Helion' lantern for Group A lighting, employing three 140W, SOI/H lamps. It comprises a lower cover spinning in galvanised steel, with a stoved enamel finish in aluminium, secured to the column by four set pins, and which supports an inverted conical bowl in opal 'Perspex' closed at the top by a 4 ft diameter copper spinning, electro-tinned and given a stoved-enamel finish in aluminium internally and externally. The canopy is supported on a vertical tube which also carries the lamp support assembly and which is secured at its lower end in the neck of an inverted metal cup by which the lantern is bolted to the column.





Optical efficiency: 77·3 per cent

Names and addresses of manufacturers

AEI Lamp and Lighting Co Ltd, Melton Road, Leicester
Atlas Lighting Ltd, Thorn House, Upper St Martin's Lane, London, WC2
Eleco Ltd, Sphere Works, St Albans, Herts
General Electric Co Ltd, Magnet House, Kingsway, London, WC2
Phosco Ltd, Hoe Lane, Ware, Herts
Revo Electric Co Ltd, Tipton, Staffs

S & L TUBULAR STEEL LIGHTING COLUMNS FOR PARK LANE

Stewarts and Lloyds have been awarded, through Atlas Lighting Limited, the contract for the supply of 40 ft. mounting height tubular steel lighting columns for the Park Lane improvement scheme. This will be the first installation in Great Britain with lighting columns of 40 ft. mounting height.

The artist's impression shows how the columns, type LC.2, and Atlas lantern SF6817/3400—specially designed to meet the requirements of the London County Council and Westminster City Council—will appear after they are installed. This column was included in our display at the A.P.L.E. Exhibition at Scarborough.

Stewarts and Lloyds' columns (manufactured to BS 1840-1960) range in mounting height from 13 ft. to 40 ft.; bracket arms vary in outreach which allows columns to be offset from the pavement edge.

Our catalogue, with illustrations and section drawings, is available on request.

STEWARTS AND LLOYDS LIMITED

Tubemakers for a Century

GLASGOW · BIRMINGHAM · LONDON

S&L

IES Activities

IN REDUCING BULB SIZES of incandescent filament lamps, lamp manufacturers would seem to have presented fittings manufacturers with a number of problems, particularly in the heating which may occur in fittings. To what extent both lamp and fittings makers have been able so far to deal with this problem in a systematic way was discussed at the November Sessional meeting of the IES in three papers, presented by Mr A. G. Penny, by Mr J. N. Bowtell and Mr J. R. Coaton and by Miss Joan Keen and Mr H. F. Stephenson.

This miniature symposium was started off by Mr Penny in a review of changes in bulb size of g.l.s. lamps since the incandescent lamp was invented. He made clear that, from the outset, bulb sizes have always been a problem. In the early days of lamp manufacture bulb sizes were surprisingly small for their wattage, and some were, in fact, smaller than they are today. The small size of bulbs was dictated by the need to obtain as high a vacuum as was possible with the then much less efficient evacuating pumps and the general tendency, during early lamp development, was to increase bulb sizes. This trend continued to the 1920s, when the wide variety of bulb sizes which had come into use was drastically reduced by the introduction of machine blowing of bulbs which forced the industry to adopt a restricted range of sizes to take full advantage of the economies offered by mass production. With the introduction of the 'simplified line' in 1927, a twenty-year period of size stability was initiated, and subsequently further encouraged by the development of discharge lamps, to which nearly all lamp research was diverted in the then confident prediction that filament lamps would have become obsolete by 1950. With the falsity of that prediction demonstrated after the war, and the inevitable slackening in discharge lamp development following the initial leap forward, manufacturers again turned their attention to filament lamps and inevitably, in Mr Penny's view, size came under review. The most recent reduction in size, in which bulb sizes have been made identical for all sizes from 15w to 100w, was seen as the result, on the one hand, of the development, in 1954, of a capping cement capable of withstanding temperatures of 200°C and higher, and on the other, of intense international competition which produced internationally agreed sizes determined by the need for maximum economy in production.

The argument was then taken up by Mr Bowtell (as co-author with Mr Coaton) in pointing to two dangers of miniaturisation: existing fittings could accept lamps of higher rating than those for which they were designed, causing an increase in the operating temperature of all parts of the fitting, whilst, for a given rating, a smaller bulb would result, in general, in a higher lamp-cap temperature, producing additional heating of those fitting components most closely associated with the cap. He suggested two safeguards: the indestructible marking of fittings with the maximum lamp wattage to be used with them and the limiting of lamp cap temperatures. The two provisions were seen as the basis on which regulations for the temperature performance of lamps and fittings could be compiled without unduly restricting the development of either. The determination of that performance, however, required the use of a standard heat test lamp.

A necessary pre-requisite of an SHT lamp was, of course, accurate knowledge of the temperature performance of general production g.l.s. lamps, as indicated by the cap temperature rise in free air. Measurements made on a variety of 100w lamps showed temperature rises ranging from 100°C for coiled-coil lamps in clear bulbs of 68 mm diameter to 143°C for single-coil lamps in pearl bulbs of 60 mm diameter. An internally diffusing coating increased the rise by a further 10°C. The industry, as represented by ELIC, had accepted a limit on average lamp-cap temperature rise of 150°C; in practice, this meant that the cap rise of all but 2½ per cent of mass-produced 100w g.l.s. lamps would be less than 160°C. Since an SHT lamp should, of necessity, have a cap temperature rise at least as high as that of the hottest production lamp, this value of 160°C was suggested as the basis for the design of such a lamp.

A request for an SHT lamp was made originally by the CEE through the IEC and the outcome, for the 230v, 100w size, was a single-coil lamp with a 60 mm, internally-coated bulb, manufactured with accurate control of dimensions and axiality. After processing, each SHT lamp was carefully aged to stabilise the filament and the cap temperature rise in free air measured at rated wattage after burning for a further hour, in an accurately determined vertical position. This lamp had been well received in principle by the CEE, who had asked for the range to be extended to cover 40w, 60w, 200w and 300w ratings with different caps, However, experience with the relatively small numbers so far made showed the SHT lamp to be subject to certain inaccuracies which made it impossible to assign tolerances to the objective value of lamp-cap temperature rise and it was assumed that users of the lamp will check this rise to ensure correct calibration before commencing tests.

The meeting then considered how fittings were likely to perform in practice and to what extent the SHT lamp was suitable for testing fittings, this aspect being discussed by Mr Stephenson as co-author of the final paper of the evening. This paper set down the results of temperature testing of nine typical fittings for domestic, commercial and industrial use, undertaken to determine the effect of lamps of different wattage (including the SHT lamp) and the variability which occurs between similar lamps in the same fitting. In the first case, for lamps of different wattage in any given fitting, the results were clear cut, showing good correlation between the rates of change of temperature rise with wattage and the actual temperature rises at the different temperature-measurement positions for a lamp of any given wattage. For example, the substitution of a 100w lamp for a 60w lamp resulted in increases in temperature rises of between 40 and 50 per cent.

Less clear cut, however, were the results from testing different lamps of the same wattage in the same fitting; the temperature rises measured were seen to vary considerably resulting from small differences in shape, bulb size, bulb finish, filament construction and light-centre length. It was assumed that these differences could be represented by the lamp-cap temperature rise in free air, and tests were carried out on one of the fittings with six types of 240v, 100w g.l.s. lamps, and a 100w, SHT lamp, all having different cap temperature rises. These showed a strong correlation between fitting temperature rise and cap rise at the hottest positions of the fitting but at the coolest positions the fitting temperature rise was found to be virtually independent of the cap rise of the lamp and depended only on lamp wattage. These tests also showed significant variability in measurements, which meant that there was a considerable residual uncertainty around the value of fitting temperature rise to be expected for a given lamp cap temperature rise. But it was clear that 60 mm g.l.s. lamps (and the SHT lamp) produced temperatures at the lamp cap of between 18°C and 36°C greater than 68 mm g.l.s. lamps, and at the cable bifurcation point from 4°C to 20°C greater.

With maximum operating temperatures of 60°C and 70°C respectively for rubber and p.v.c., overheating of cable insulation was seen to present a difficult problem, being most severe at the bifurcation point. The authors got round it by suggesting that as deterioration follows a time/temperature relationship, the limit could be increased to 85°C to give a satisfactory life, provided the cores were not disturbed or the cable not subjected to mechanical stress. Even on this basis, four of the nine fittings were not satisfactory with rubber- or p.v.c.-insulated cables and all would have required the use of heat-resisting insulation if the 60° or 70°C limits were to be observed. In general, it was concluded that operating temperatures were now such as to necessitate discarding all the relatively cheap

materials used hitherto, particularly for some 'contemporary' fittings. Whilst temperatures could be reduced by drastic redesign, sacrificing appearance and increasing cost, it was contended that in some cases, fittings designers would have to accept high operating temperatures and provide suitable materials at critical points.

The authors were also somewhat critical of the present SHT lamp, arguing that the margin it provided on lamp-cap temperature rise (only 25°C) was too small to avoid rejection of many designs which with production lamps would prove acceptable. But even if a greater margin could be agreed, they suggested that about one-third of present day fittings would need modification to become acceptable. They went on to show, however, that the whole question of temperature testing of fittings was hedged about with uncertainties arising out of the lack of repeatability of tests—even of the same test on the same lamp and fitting left undisturbed from the previous test. Miss Keen went into a masterly statistical analysis of the data compiled from the tests, to determine the degree of variability likely to be encountered in practice, and thus to draw up reliable criteria for acceptance or rejection of a fitting after having been tested. She showed that, even under ideal conditions, fitting temperatures were subject to an inherent variability, with deviations ranging from ½°C to 3½°C for measurements made in one laboratory, and she suggested that an overall deviation of 5°C should be adopted as standard, to cover all likely variabilities, including discrepancies between different laboratories. This deviation meant, however, that when testing a fitting against specified temperature limits, uncertainty was introduced if the results of the test lay within 5°C of the limits. The uncertainty could be largely removed if a large number of tests were made and a mean value derived but, in practical, routine testing, such a solution was obviously precluded by shortage of time. She suggested a sequential test procedure, in which the magnitude of the first test would decide whether a second test was to be made, the results of the latter being decisive. Such a procedure would inevitably mean that some fittings with true temperatures just below the limit would be rejected and other fittings with temperatures within about 5°C above would be accepted.

From the ensuing discussion, in which about a dozen speakers participated, it was clear that the domestic situation was causing most concern. Whilst it was thought possible to make the temperature performance and testing of fittings the subject of a British Standard, this would exert little if any control over the householder employing lamps in pendant lampholders and shades. The problem presented by bathrooms, where insulated materials were required to comply with the IEE Regulations, was also raised. Generally, the moulded lampholder was condemned as unsatisfactory, the point being made that at its introduction before the war it was never intended for use with lamps of greater than 60w. The idea of a marking for all fittings was generally applauded, but doubt was expressed on the possibility of making it permanent. It was also felt that whilst the testing of fittings had to be carried out in such a way as to ensure that the possibility of fire was eliminated, there was need to be more fully informed of the nature of the materials used in fittings and of the potential fire risk each presented. On the same ground, doubt was expressed of the proposal to increase the temperature limit for cable insulation.

IES News

The following were elected into membership of the IES in November:

Corporate. J. R. Cox, C. I. Denson, J. J. Docherty, S. H. Fraser, E. H. Leek, E. A. Mellows, P. J. Peters, G. H. Robertson, P. Scott.

Student. M. J. Greening, J. B. Hillary, I. J. MacKenzie, P. Nossek, W. A. Rees.

Student-Corporate transfer. R. S. Halfacre.

In the Centres

AT THE OCTOBER meeting of the Birmingham Centre, Mr J. W. Bessant successfuly gave an address on colour floodlighting, despite difficulties caused by inability to bring some of the demonstration pieces into the lecture room. He was concerned to show how the expert used light in the production of colour and demonstrated the merits of various types of light source. He also showed that the transient effects painted in light for 'Son et Lumière' spectacles required very different treatment and control than that adopted for the static floodlighting of buildings, as exemplified by the Fountains Abbey display.

At its first meeting of the current session, Hull Centre were treated to a lecture on office lighting by Mr L. H. Hubble, in which he reviewed lighting from the oil lamp to the modular troffer fitting. He pointed to the half-million offices estimated as being in need of better lighting, some of them so badly lit that they could not hope to attract school-leavers and other young people conditioned to much better standards. Glare was seen as the culprit, imposing strain and discomfort. He went on to outline the three-point grid system showing how it ensured that fittings were correctly sited in relation to the work being done, and was also capable of operation as a permanent supplement to daylight, and concluded by discussing the economic and other advantages which would accrue from a proper integration of engineering services with architecture.

The Leicester Centre of the IES has had two successful meetings recently. The first was the opening meeting of the session in which the new chairman, Mr H. R. Ruff, delivered an address on the engineering problems associated with new light sources, in developing them from the research stage to mass production. His example was the now commonplace tubular fluorescent lamp. The stages in its laboratory development were illustrated by a short study film and he then went on to describe the programme which carried the lamp from the stage of pre-production in small quantities to mass production, showing the use of market research and the progressive expenditure of capital required to keep pace with the expected demand. At the second meeting, Dr W. E. Harper gave a well-attended lecture on the new IES Code, also describing the proceedings at the London meeting last April when the Code had been introduced. Pointing out that, in the six months since then, some 7,000 copies of the Code had been sold, Dr Harper said that it was convincing evidence of the lighting public's interest in the activities of the IES.

Forthcoming Events

LONDON

December 12

Informal meeting: Applying the IES Code; discussion to be opened by Dr H. H. Ballin. Federation of British Industries, Tothill Street, SW1, 6 p.m.

CENTRES

December 6

NEWCASTLE-UPON-TYNE. The use of coloured light, by J. W. Bessant. Room B7, Percy Building, King's College, Queen Victoria Road, 6.15 p.m.

December 7

CARDIFF. Visual problems of motorways, by J. M. Waldram. Bowchier Hall.

GLASGOW. Visit to testing section of Glasgow Corporation Lighting Department, 20 Trongate, 6.30 p.m.

MANCHESTER. Fundamental principles of street lighting, by C. S. Bayliffe. Demonstration Theatre, NW Electricity Board, Town Hall Extension, 6 p.m.

NOTTINGHAM. The new IES Code, by A. Roberts. Electricity Centre, Carrington Street, 6 p.m.

December 11

BIRMINGHAM. Visit to Longbridge Works of Austin Motor Company.

LEEDS. The problems of lighting urban motorways, by G. K. Lambert. City Art Gallery, The Headrow, 2 p.m.

LEICESTER. Lighting for inspection, by H. E. Bellchambers and S. M. Phillipson. Demonstration Theatre, E Midlands Electricity Board, Charles Street, 6.15 p.m.

SHEFFIELD. Impressions of the USA, by A. Roberts. Grand Hotel, 6.30 p.m.

December 13

SWANSEA. Luminous ceilings and modular fittings, by R. L. C. Tate. Demonstration Theatre, S Wales Electricity Board, The Kingsway, 6 p.m.

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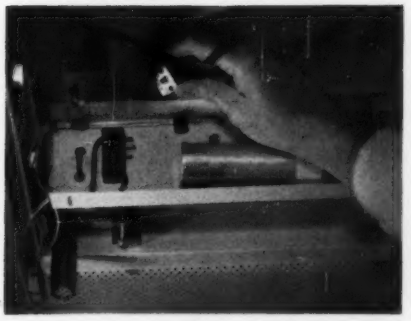

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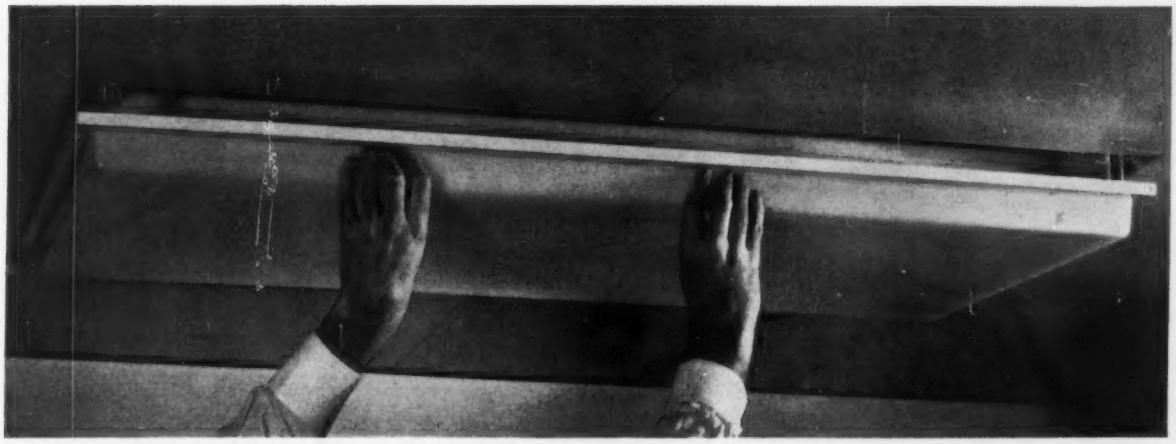

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MISCELLANY

Book Review

Atlas Lighting Manual; published by Atlas Lighting Ltd, pp. 211 *plus index and appendices; price* 25*s.*

This comprehensive publication, edited by H. Hewitt and H. C. Weston, contains sixteen main chapters written by members of the staff of Atlas Lighting Ltd. Starting with the visual processes and visual needs, it goes on to the production of light and the application of lighting equipment and lighting techniques. The chapters are: Light and sight; Looking and lighting; Production of light; Incandescent lamps; Principles of luminescence and electro-luminescence; Principles of discharge and fluorescent tubes; discharge lamp and tube types and circuits; Control gear; Colour in lighting; Control of light; Lighting fittings; Lighting calculations and measurements; Installation and maintenance of lighting equipment; Lighting in industry; lighting for offices and schools; lighting for selling.

The appendices contain a glossary, conversion tables for units of illumination and luminance, notes on direct glare and technical data on Atlas lamps and lighting equipment. The manual is in loose-leaf form so that amendments to technical and fittings data may be added.

A great deal of information has been packed into the pages of this manual; so much in fact that the presentation of it in places has been spoiled by overcrowding. Reproduction of photographs is not very good but the full-colour CIE chromaticity chart is first-class. Only one chapter (Calculations) gives a list of references; the addition of similar lists to other chapters, or the inclusion of even a selected bibliography, would have added to the value of the publication. One gets the impression that the manual probably grew beyond the original intentions though there is space at the end of each chapter where references could have been included.

The section on Calculations and Measurements is one of the longest and in view of interest created by the IES Code and Technical Report No. 2 will be closely studied, particularly by lighting engineers. It is a pity therefore that some of the terms used differ from those used by the IES. In the first place the manual uses 'utilization factor' whereas TR No. 2 uses 'coefficient of utilization'; it must be pointed out that Atlas have the BSI on their side though the IES gives good reason, particularly colloquial usage, for adopting 'coefficient'. Another difference is that whilst the IES has gone over to a number for Room Index, Atlas stick to the letters A to J though they also give a corresponding number as Room Ratio. The symbols used for room dimensions also differ—*L* and *W* for length and width in TR2 and *b* and *w* for the same dimensions in the manual. Such differences can only cause confusion.

The last hundred pages or so give data on Atlas lamps and lighting equipment. Here again a great deal of information has been packed into the available space. The manual as a whole is a great achievement and most lighting engineers and electrical contractors and no doubt more than a few architects will want a copy and find it extremely useful.

L. L.

Personal

The Council for Scientific and Industrial Research has appointed Dr J. V. DUNWORTH as Deputy Director of the NPL in succession to Dr G. Macfarlane. Dr Dunworth is at present Deputy Director of the Atomic Energy Establishment at Winfrith.

The COID announce the appointment of Mr NIGEL CHAPMAN as industrial liaison officer for engineering consumer goods in succession to Howard Upjohn. Mr Chapman (who designed the 'Satina' range of lighting fittings which gained a Design Centre award in 1958) will be responsible for the Council's contacts with manufacturers of appliances, including lighting fittings.

Mr G. SINGLETON has joined the board of SLR Electric where he will be responsible for broadening and promoting the firm's engineering and design services. He started with the GEC in Australia, joining its head office in London on demobilization from war service.

Previously assistant chief electrical engineer of AEI (Manchester), Dr L. W. BROWN has been appointed technical director of the AEI Lamp and Lighting Co. He succeeds Dr A. B. Whitworth who is relinquishing his post on medical advice but will continue as technical consultant and designer until his retirement next year. The same firm also announce that Mr L. G. LEWZEY has been appointed secretary of the company.

Mr H. HEWITT has been appointed deputy manager of the Atlas Lighting Laboratories in addition to his present responsibilities as manager of the firm's Lighting Development Group.

Mr R. J. FOTHERGILL has been appointed technical and general manager of the Arctic Fuse and Electrical Manufacturing Co.

Situations

Vacant

DESIGNER DRAUGHTSMAN required for interesting work on lighting fittings mainly fluorescent. Must have sound knowledge of engineering principles and be capable of original thought. The work requires a knowledge of modern manufacturing methods including pressure die-casting, injection and compression moulding and extrusion of plastics, sheet metal fabrication and electrostatic painting. Superannuation, canteen facilities, excellent working conditions. Apply to Personnel Officer, Crompton Parkinson (Doncaster) Ltd, Wheatley, Doncaster.

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Announcement

A ONE-DAY SYMPOSIUM on Hospital Lighting is being held in University College, Gower Street, on 5th January, 1962, under the sponsorship of the Ministry of Health and the DSIR Building Research Station. The Symposium is designed for architects and engineers, both from Regional Hospital Boards and in private practice and others particularly concerned with problems of hospital lighting. Papers will be given on the principles of hospital lighting, light sources and engineering, architectural and medical requirements. These will be followed by a discussion. The Conference will be introduced by Professor Richard Llewelyn Davies, and the principal speakers will be Mr J. Constable, Dr B. H. Crawford, Mr J. Green, Dr S. T. Henderson, Dr R. G. Hopkinson, Mr J. Musgrove, Mr D. J. Petty and Dr Wellwood Ferguson. The cost of the course including coffee, lunch and tea will be one guinea. The numbers attending the course are limited and applications, together with the price of the tickets, should be made as soon as possible to Miss J. M. Beauchamp, Ministry of Health, Savile Row, W1. Cheques and postal orders should be made payable to the Ministry of Health and crossed 'Bank of England A/c, HM Paymaster General'.

Answers to Lumeritas Quiz:
1 (*a*); 2 (*c*); 3 (*b*) and (*c*) but the term 'photon' in this context is now out of use 4; (*e*). It was first enunciated, so far as I know, by Johann H. Lambert; 5 (*a*) and (*d*); 6 Possibly (*a*), otherwise (*e*); 7 (*e*). The others were all at the NPL at one time; 8 (*b*); 9 (*a*) as near as matters; 10 (*b*); 11 (*b*); 12 (*c*); 13 (*c*). The others gave their names to standards of light; 14 (*c*); 15 (*a*); 16 (*c*); 17 (*a*); 18 (*c*); 19 (*d*); 20 (*b*) and (*c*), one and the same man.

Postscript

THE GROWING HABIT of commercial vehicle drivers of signalling to one another with their headlamps and stoplights is a procedure which had some common sense behind it at first but which has now got out of hand. Not only is there no established code, but lorry drivers seem to expect private car drivers to know every code and act upon the information. Driving at night, during the rush hour, on a wet night in an unfamiliar town taxes the human receptor and motor skills virtually to their limit. If on top of all this we have to be on the look out to distinguish between 'I am going to pull out and pass you' and 'Thank you for your signal' played on the headlamps of the lorry behind, there are obviously going to be accidents and the wrong fellow will get the blame. The MOT and the police must make up their minds about the value of these signals. If they serve a useful purpose, they should be codified and incorporated in the Highway Code with strict instructions when not to use them.

THE MAN WHO THOUGHT a foot-lambert was 2 per cent of the daylight outside has made some of my readers comment 'There but for the grace of God go I'. This is the season of Christmas quizzes, and the occasion seems too good to miss. The questions below are out of a mixed bag. Most of them have one answer only, but some have two.

1 Of 100 watts consumed by a fluorescent lamp, the light output accounts for approximately: (*a*) 22 watts, (*b*) 55 watts, (*c*) 90 watts, (*d*) 5 watts, (*e*) none of these?

2 Beer's Law is an expression for: (*a*) The reflectance from a semi-specular surface, (*b*) the polarisation of light, (*c*) the transmission of light in turbid liquids, (*d*) the distance of the planets from the sun, (*e*) none of these?

3 A *troland* is: (*a*) A candela (US usage), (*b*) a photon, (*c*) a unit of retinal illumination, (*d*) a small sled used in New England, (*e*) none of these?

4 The Cosine Law of Illumination was first enunciated by: (*a*) Balfour Stewart, (*b*) Fox-Talbot, (*c*) Paracelsus, (*d*) Foot-Lambert, (*e*) none of these?

5 A *nit* is: (*a*) 3·142 apostilbs, (*b*) 10 lumens per sq ft, (*c*) 1·076 millilamberts, (*d*) 0·292 ft lamberts, (*e*) none of these?

6 Cosmic rays emanate from: (*a*) The stars, (*b*) radium, (*c*) heavy water, (*d*) a cloud chamber, (*e*) none of these?

7 Which is the odd man out: (*a*) Walsh, (*b*) Buckley, (*c*) Stiles, (*d*) Paterson, (*e*) Beuttell?

8 A *galloway* is: (*a*) 452 candelas per sq in., (*b*) a pit-pony, (*c*) a unit of electrostatic force, (*d*) a photon, (*e*) none of these?

9 The *sky factor* is: (*a*) The ratio of the illumination at a point in a room received directly from the sky to that from the unobstructed sky on a horizontal plane, (*b*) the solid angle subtended at a point in a room by the window, (*c*) the luminous efficiency, in lumens per watt, of the total radiation from the natural sky, (*d*) $2\pi \sin\theta \cos\theta$, where θ is the mean angle of elevation of a window, (*e*) none of these?

10 A 10 per cent increase in the voltage applied to a fluorescent lamp increases the light output by: (*a*) 35 per cent, (*b*) 11 per cent, (*c*) 3 per cent, (*d*) 54 per cent, (*e*) none of these?

11 *Topology* can be described as: (*a*) The science of current events, (*b*) the mathematics of a rubber world, (*c*) the treatment of hair disorders, (*d*) an Eastern philosophy, (*e*) none of these?

12 A piece of string girdling the earth around the equator is just long enough to meet when touching the ground everywhere. It is now made one yard longer. How far will it stand out from the earth's surface: (*a*) 0·314 mm, (*b*) 0·00012 mm, (*c*) 6 in., (*d*) 1 cm approximately, (*e*) none of these?

13 Which is the odd man out: (*a*) Hefner, (*b*) Harcourt, (*c*) Dow, (*d*) Carcel, (*e*) Methven?

14 Heisenberg enunciated the: (*a*) Law of heat transfer, (*b*) law of diffusion of light in fog, (*c*) uncertainty principle, (*d*) law of radiation from point sources, (*e*) theory of special relativity?

15 A *lux* is: (*a*) 0·0929 lumens per sq ft, (*b*) 3·142 apostilbs, (*c*) 1·076 phots, (*d*) 10 ft candles, (*e*) none of these?

16 A *hertz* is: (*a*) 1,550 candelas per sq mm, (*b*) 4π lines of force per sq cm, (*c*) one cycle per second, (*d*) the work done in bringing unit N pole from infinity, (*e*) none of these?

17 Ancoramic work is: (*a*) Very close work, (*b*) repetitive work, (*c*) work devised for elderly people, (*d*) conveyor belt work, (*e*) none of these?

18 A carbon arc crater has a luminance: (*a*) Ten times as bright as the sun, (*b*) thirty-four times as bright as the sun, (*c*) one-tenth as bright as the sun, (*d*) as bright as the sun, (*e*) none of these?

19 The ideal reflectance for the white paint of the inside of an integrating sphere is: (*a*) 99·4 per cent, (*b*) 100 per cent, (*c*) 98 per cent, (*d*) 80 per cent, (*e*) none of these?

20 Luckiesh is the name of: (*a*) A Russian mathematician, (*b*) a trombonist, (*c*) an American researcher, (*d*) a Czech virtuoso pianist.

The answers appear on page 389.

I must confess that I started drafting this quiz under a private pact that I would only ask questions to which I knew the answers, but I had to give up at a very early stage indeed. No doubt the questions are too easy; if they are, I shall make them much harder next time.

A YEAR HAS PASSED since I dropped a hint that the IES might lend some technical aid in the matter of Christmas lighting decorations, a hint, incidentally, which has gone unheeded by the Papers Committee. I mentioned then the decorations in the streets of my home town. I have just discovered that the electric current for this quite attractive little installation was donated by the citizens, by the simple and inexpensive expedient of wiring each array of lamps to a power point in the nearest dwelling. Now, unfortunately, a zealous officer of the local electricity authority has got wind of this admirable and public spirited arrangement, and, as far as I can make out, has insisted that the full charge of sixpence per unit (for 'lighting') must be paid instead of, presumably, the much lower all-in rate which each of the donors were paying together with their standing charge. The locals are muttering about Scrooge. I hope Mr Spenlow hears about the matter in time to put his Jorkins back in his place.

A Merry Christmas to you all, and God bless us, every one.

'Lumeritas'

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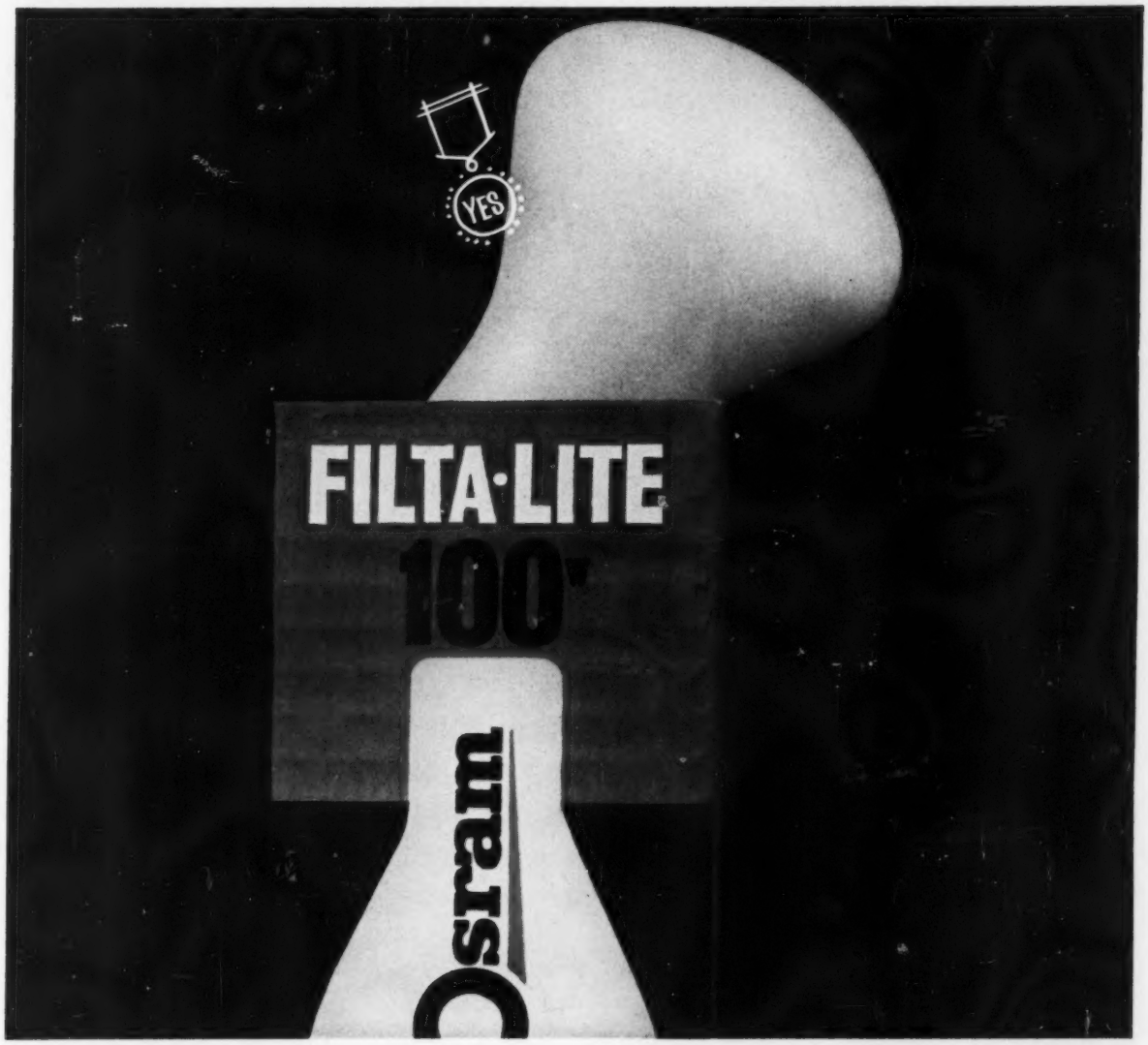

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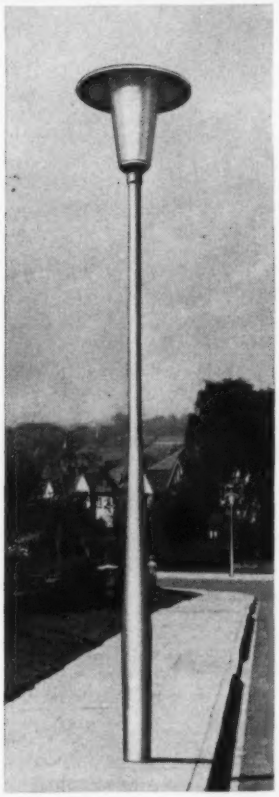

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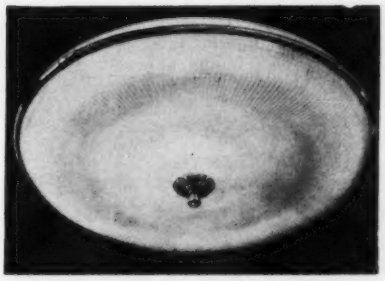

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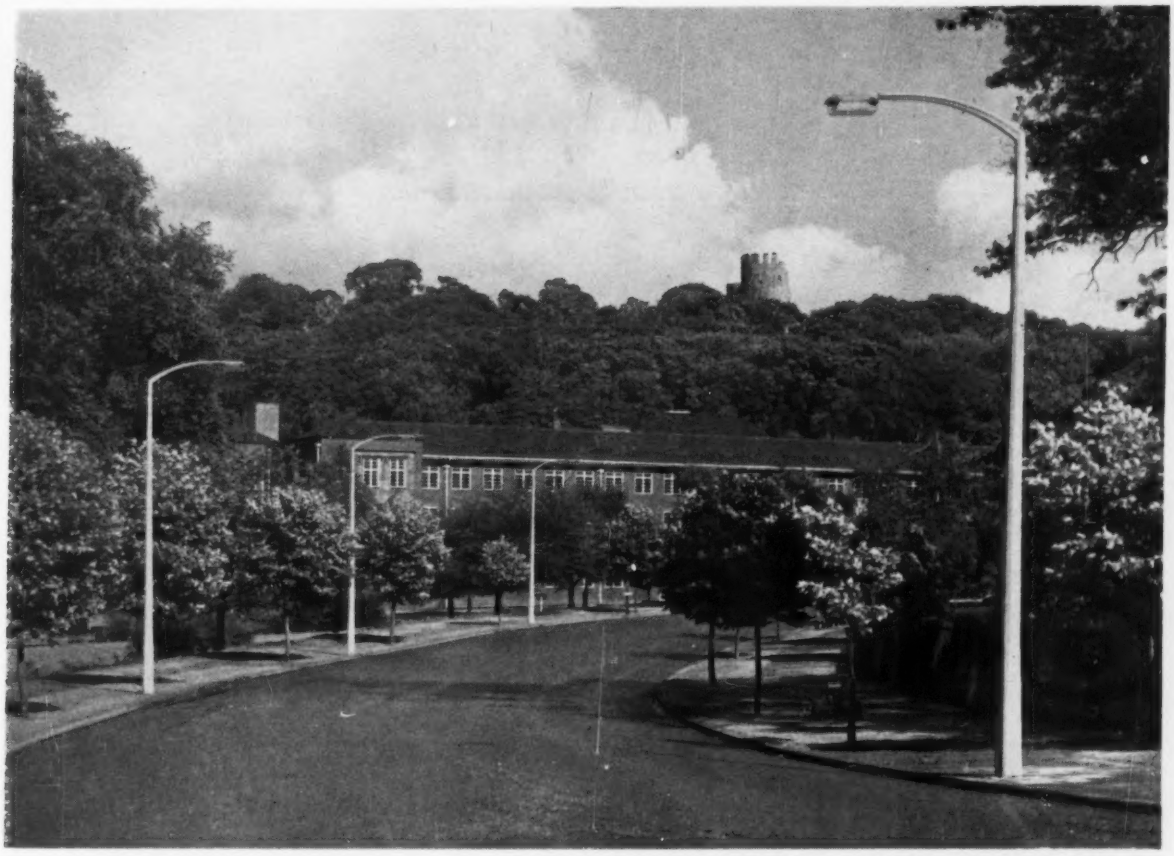
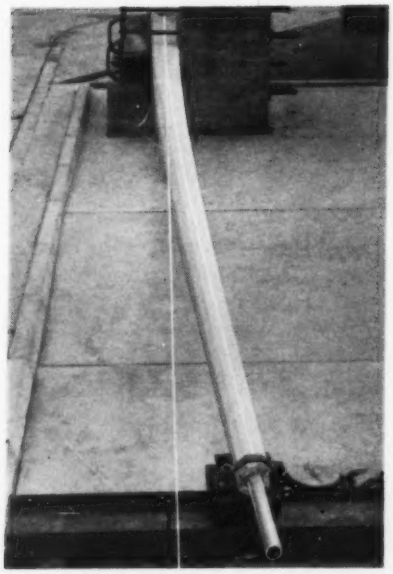


Photograph by courtesy of D. S. Warren, A.M.I.C.E., A.M.I.Mun.E., Engineer and Surveyor, Dudley.



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